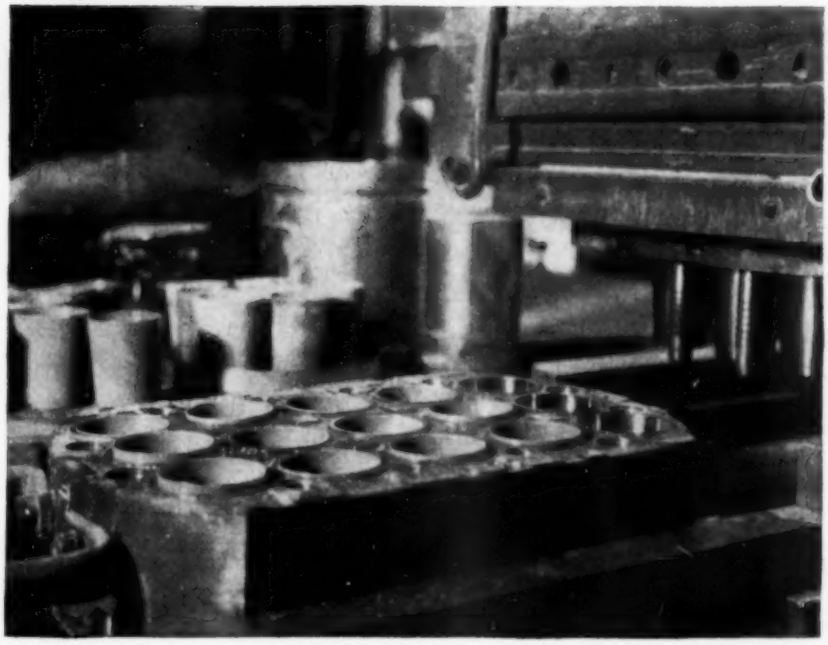
American Machinist

Established 1877 McGraw-Hill Publishing Company, Inc.

New York, April 30, 1931



In the Insulation Manufacturing Company plant this fifteen-cavity mold is placed on sliding ways. During the four-minute cure the operator weighs out each charge

Molding the Newer Plastics

For the executive, engineer, and operative, the practice followed commercially in using the urea and cellulose-acetate plastics is here summarized. In another article, to appear shortly, data on molding nitro-cellulose, casein, and styrol plastics will be given

SINCE the introduction of cellulose nitrate in the form of Celluloid, of hard rubber compounds sometimes termed Vulcanite, and later of phenolic resins in the form termed Bakelite, the importance of plastics has increased steadily; they have become ever more useful to the metal-working industry. Today consumption of these types of materials, made under a variety of trade names, is large and many relatively new plastics have been introduced, some of an entirely different base than was common heretofore.

Recently demands for color have proved a boon to some of the newer plastics and have led certain makers of the older forms to furnish their materials also in a large variety of colors, some opaque and others translucent or transparent. Naturally, with the introduction of new plastics variations in molding practice have been necessary. These differences in practice concern not only the molders themselves but also affect the purchase of molded parts by manufacturers who have no molding equipment of their own.

Perhaps the most widely used of the newer plastics, are the urea resins sold in this country under such names as Beetle, Aldur, and Unyte. Speaking generally, parts made from these resins are harder, lighter in color, and

more translucent than parts molded from phenolic resenoids. Consequently, the urea resins have been used to date more especially in applications where attractive appearance is an asset, as for dishes, clock cases, and the like.

In general molding, urea plastics are not greatly dissimilar to the phenolic resinoids, but there are detail differences of importance. The same molds can be used, however, except that in the case of thio-urea compounds chromium plated molds are recommended to avoid corrosion. Molding pressure recommended is about 2,000 to 5,000 lb. per sq.in., depending upon the grade of material used. The harder (less plastic) grades require the higher pressure but give a more lustrous finish. Steam at a pressure of 65 to 85 lb. per sq.in., corresponding to temperatures of 297 to 316 deg. F., generally is employed, but gas or electric heating is equally satisfactory if properly controlled. In any case, for best results the temperature *at the mold surface* should approximate 275 to 280 deg. F. In general, steam pressures of 100 lb. per sq.in. or above should not be used as the material is likely to be burned at the corresponding temperatures (338 deg. F. upward). Radiation, especially from large molds, may be so high, however, that pressures in excess of 100 lb. are permissible to bring the mold cavity surface up to the desired temperature.

Curing Under Pressure

Curing time under pressure varies somewhat with the thickness of section of the part molded, but ordinarily is 4 to 6 minutes. Successful molding has been done on thin sections with a cure as short as 2 minutes. Other pieces with relatively thick sections take up to 10 minutes. Higher temperatures within the allowable range tend to decrease the curing time somewhat. One molder who makes drinking tumblers with a $\frac{1}{16}$-in. wall of Aldur in a sixteen-cavity mold operates on a 10-minute cycle including a 5-minute cure at 275 deg. F.

A decided under-curing is indicated by a sticky surface, but a more certain test is to immerse the molded article in boiling water for ten minutes. If it remains unaffected it is properly cured. Incomplete curing is still possible even though the surface is hard and sometimes is evidenced by cloudy patches in the article. Such patches are caused also by insufficient pressure, especially in complicated molds. Complete curing adds strength and increases resistance to water.

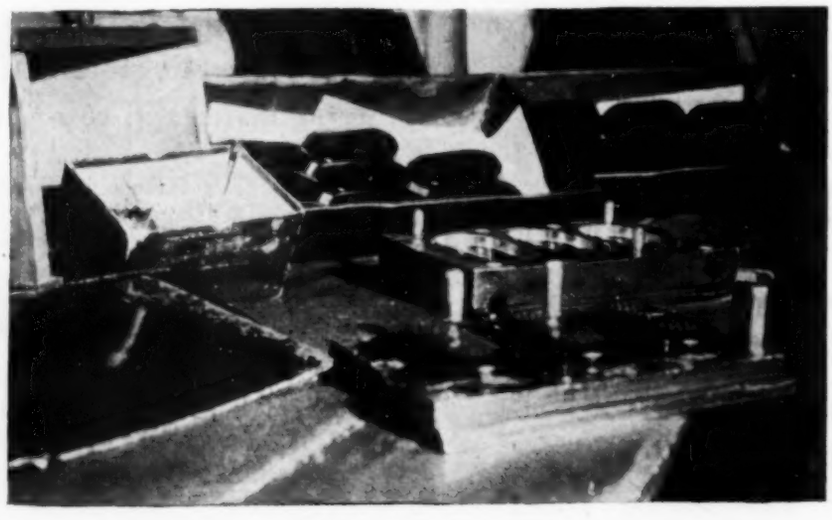
Urea resins are relatively free-flowing, hence care must be taken not to close the press too rapidly, especially in flash-mold work, otherwise material may be lost and opaque patches will appear on translucent grades. It is necessary also to "breathe" or "gas" some molds by opening them for a few seconds just as the flow ceases, to permit the gas formed to escape. In other molds tapping or jarring by releasing the pressure momentarily and then applying it suddenly again, frees any trapped gas.

Molds are not attacked chemically by pure urea resins, hence need not be chromium plated or made of noncorrosive material, but the thio-urea type, which incorporates sulphur, must be molded in stainless steel or chromium plated molds. In either case molds should be polished if a high finish is desired on the molded part. The latter is readily buffed to a high finish, however, if its luster is not so high as desired.

Although open or flash-type molds are preferable, positive or closed molds are used successfully. If powder is used in charging positive molds, the cavity, including loading portion, should have a volume at least four times that of the finished piece. A loading plate and a separate flat bottom plate are used to advantage in some cases to facilitate "gassing" and permit escape of any excess material. If the correct quantity of material is used, fins are paper-thin, and where proper curing is done are so brittle as to be broken away easily with the finger. Consequently, their removal is effected at very small cost.

Granulated urea resins can be preformed into "biscuits" or "pills" to reduce bulk and to facilitate handling, but the pressure required is greater than that needed in preforming phenolic resins. Preforming machines as well as presses and molds that have been used for phenolic resins must be thoroughly cleaned before use with urea resins, as even a slight speck of foreign matter or dirt may ruin an entire piece, especially if a light colored material is being molded. For this reason some molders find it desirable to house urea molding equipment in dust-proof rooms and to use such equipment for this material only.

Almost any color from delicate pastel shades to deep colors or black can be furnished in urea molding materials. When the coloring matter is a dye or contains relatively little pigment, the material remains translucent and its beauty is enhanced. Many colors are sunfast, at least for all ordinary indoor exposure, but certain of the lighter tints fade in strong light, apparently because of the very small amount of dye (as little as



Lumarith mold and molded parts made by the Insulation Manufacturing Company. To secure the exact color and mottled effect desired in the finished part, squares cut from sheet plus chip stock are placed in each cavity along with scraps of flash to form the weighed charge. No material is wasted. After heating and closing the mold in a hot press, it is transferred to a cold press until cool

0.001 per cent in some cases) required. Additions of more opaque white makes it possible to use more dye and thereby make the color more nearly permanent, but at the expense of some translucency.

Mottled, striated, or clouded effects in great variety can be produced by using chips or powders of different colors in the same charge. Powder is recommended wherever feasible because it gives a more homogeneous piece with a finer and smoother effect and one free from imperfections. Granular forms are best for preforming, have less bulk than powder, cure somewhat faster, and come from the mold with a higher polish.

At present prices urea resins sell for about two and one-half times as much as black and brown phenolic resins, but are about on a par in cost with phenolic resins of corresponding light or bright colors. Fillers are not used in molding most translucent articles from urea resins.

Urea molded articles, even when they have quite thin sections, are relatively "unbreakable" despite their hardness. The tensile strength of the molded material is given as approximately 8,500 lb. per sq.in. and its specific gravity as about 1.5. Other mechanical as well as electrical qualities are said to be similar to those of phenolic molded parts. Weak acids and alkalies do not affect articles of molded urea resins and they withstand temperatures up to 250 deg. F. continuously and higher temperatures for short periods. Laminated materials made from paper and fabric impregnated with urea resins also are manufactured.

Cellulose Acetate Plastics

Molded parts are made today in considerable quantities from the cellulose acetate product termed Lumarith. They may be transparent, translucent, mottled, or opaque and consequently lend themselves especially to applications in which ornamental effects are desirable. Although the acetate plastics sell for two to five times as much as urea plastics and, because they must be cooled in the mold, usually require about twice as long to mold, their great beauty and certain other qualities make them especially desirable for many articles. Lumarith is made in slab, chip, and powder form and in three grades, hard, normal and soft. Unlike phenolic and urea plastics, the cellulose acetate plastics can be remolded.

Molding of Lumarith is done under normal conditions at a pressure of about 2,000 lb. per sq.in. Temperatures of steam used satisfactorily range from 267 to 365 deg. F., or the equivalent of 25 to 150 lb. per sq.in. gage steam pressure.

When preheated tablets or biscuits are to be formed in channel molds, the latter are closed slowly, the pressure being checked once or twice to allow all granular particles to be heated thoroughly before full pressure is applied. Molding is complete as soon as the mold is fully closed and chilling should start immediately, the mold being placed in a chilling press. A slight cracking sound during the molding operation indicates that the material is not sufficiently plastic to flow properly, and the pressure should be checked (held) longer.

In using blanks, chips, or powders in hot molds without preheating, light pressure only is applied until the material is thoroughly softened, after which the full pressure is applied very slowly. When the mold is fully closed and still under pressure it is chilled to about room temperature or to a temperature which will prevent distortion of the part upon discharge. This temperature depends upon the shape of the article and its wall thickness. In some cases discharge at a temperature as high as 140 deg. F. is permissible. Parts from transparent or translucent material sometimes can be molded at somewhat lower temperatures than parts of opaque material.

Depressions upon the surface of molded cellulose acetate articles are caused by gas or air locks or by excessive wall thickness at points beyond a thin section. Defective parts of this kind can be salvaged by remolding, adding a small amount of preheated scrap or fresh material after the piece is thoroughly softened. A mold may fail to close completely if over-filled, if an air lock occurs, or if the material is not heated sufficiently. Cracks and depressions in molded parts sometimes are filled with a paste made from material of the same color by partly dissolving it in a solvent such as acetone.

Lumarith is chemically inert, hence unplated molds of hardened carbon steel are employed. Cavities should be polished to insure a high luster on the molded part. Molds in which provision is made for circulating the heating and cooling fluids around the cavities in such a way as to transfer heat rapidly are preferable as they tend to shorten the time cycle. Open or flash molds cost less than the positive type, and because of decreased depth, they heat and cool more rapidly. Space for flash should be about $\frac{1}{16}$ in. wide. The fin is readily removed.

Provision for shrinkage always should be made in designing the mold. The allowance recommended is from 0.001 to 0.0025 in. per linear inch for opaque material and 0.003 to 0.005 in. per inch for transparent, the amount depending upon the molding temperature.

Molds for use with powdered Lumarith should have filling space for approximately two and one-half times the volume of the finished piece. Sharp corners in the mold should be avoided wherever possible. Depressions and projections should be given a draft of 0.005 in. per inch in the line of draft, to facilitate ejection of the piece. Forces and cores should be made without sharp or pointed edges wherever possible.

As with urea plastics, the molding of cellulose acetate in light colors requires care to eliminate dust, grease, and other contamination in handling and processing..

Information contained in this article is compiled from data furnished by makers of the materials dealt with and by the Insulation Manufacturing Company.

■

What is Fitting?

HARRY SHAW
Consulting Engineer, Heywood, Lancashire, England

WHILE talking to a prominent English builder of machine tools about his shop, I remarked upon the small number of fitters employed. He then explained that he was aiming to eliminate all fitting, and was honing all lathe spindle bearings instead of scraping them.

He said that he had been trying to get rid of fitting ever since he had been in America, for when there he was asked by an American turret lathe manufacturer what fitting was. After a little cogitation he replied, "Fitting is fitting—what is your definition of fitting?" The other replied, "Fitting is the rectification of defective machining."

NEW BOOKS

•

A HANDBOOK OF ENGINEERING USAGE—*By A. C. Howell, Associate Professor of English, University of North Carolina. 308 pages, 5x7½ in. Indexed. Cloth board covers. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price $2.50.*

With true engineering economy, the author has picked from the mass of detail that comprises English, the essential items that are most needed by and least known to the average engineer who undertakes to write a report, a paper, an article for publication, even an ordinary business letter. He has so arranged these items that any point about which the engineer is troubled can be found readily without the aid of luck or the necessity of reading the entire book. Every paragraph is self-contained, exemplified, numbered, and indexed. So also are sections and chapters. These latter treat of General Characteristics of Engineering Writing, The Word, The Sentence, The Paragraph, The Whole Composition, Punctuation and Mechanics, Grammar, The Business Letter, The Report, and Technical Magazine Articles.

According to its preface the book is designed to be a handbook just as are books on materials and specifications. The preface is modest; this book is all that it claims to be and more; it even makes good reading.

AMERICAN DIESEL ENGINES—*By L. H. Morrison. 606 pages, 5¾ x 9 in. Cloth board covers. Indexed. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $5.00.*

Readers who desire a comprehensive discussion of American-built Diesel engines will find it in this volume. It not only describes these engines and treats to some extent the theory of design, but contains chapters on operation and adjustment, the relative cost of Diesel and steam plants, installation, lubrication, cooling, and testing. Some sections deal also with repair methods.

Although originally intended as a revision of his earlier book, entitled "Diesel Engines," the author found that developments in this type of engine had been so broad that only a complete re-writing would meet the requirements. As only engines built in this country could be included within a single volume, the title was changed and the new volume is termed a first edition.

INDUSTRIAL ACCIDENT PREVENTION — A SCIENTIFIC APPROACH—*By H. W. Heinrich, Assistant Superintendent, Engineering and Inspection Division, The Travelers Insurance Co. 366 pages 5⅜x8 in. Cloth-board covers. Indexed and illustrated. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York, N. Y. Price $4.00.*

The causes, costs, and remedies of accidents are summarized from an insurance man's viewpoint. There can be no argument as to the desirability of adequate prevention measures in all industrial plants. Until such measures are understood and applied universally, books of this kind will be published. Accident causes are classified as to nature and as to industry. Cause-analysis is explained in the light of the selection of suitable remedies for specific cases. Executive enforcement and employee education are cited as essential components of an accident prevention program. Detailed descriptions are given of physical and psychological means of prevention.

The book concludes with accident statistics and an appendix outlininig particular phases of prevention work. Illustrations are plentiful, but not all are clear.

HENLEY'S TWENTIETH CENTURY BOOK OF RECIPES, FORMULAS, AND PROCESSES, (REVISED EDITION)—*Edited by Gardner D. Hiscox, Mechanical Engineer, 800 pages, 6x9 in. Illustrated. Indexed. Clothboard covers. Published by the Norman W. Henley Publishing Company, 2 West 45th Street, New York, N. Y. Price $4.00*

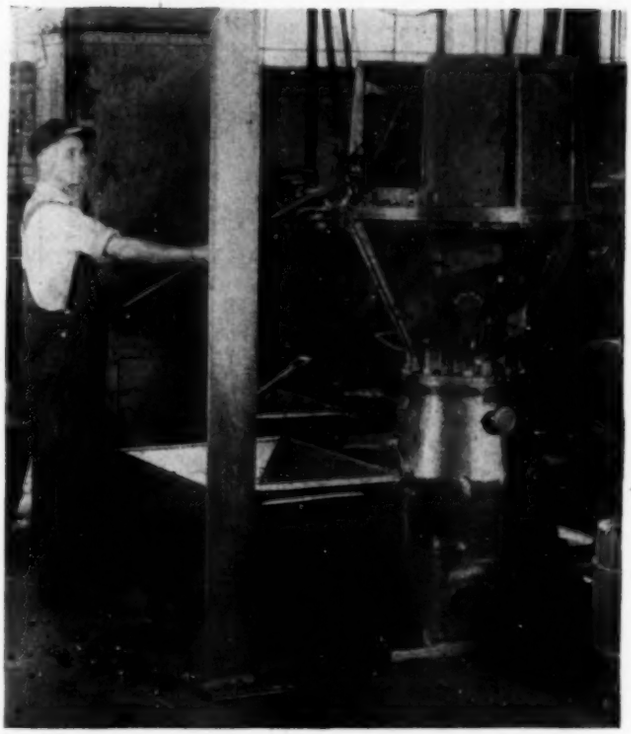
Ten thousand formulas, processes, and trade secrets are supposed to be included in this book, and even a cursory examination will convince the most skeptical of the supposition. Everything from formulas for varnishes and beverages to methods for silvering mirrors, plating, enameling, alloying, and cleaning is included, together with information on such unrelated subjects as removing tattoo marks and preserving eggs. It is a reference book for the "home, church, workshop, and school," and has been a standard as such for the last 24 years. It does not give shop information to the exclusion of everything else; it is simply a mine of unrelated but practical information and almost as indispensable as a dictionary or an encyclopedia. Formulas and processes given are explained as points of departure for further experimentation to suit particular requirements, be it cheese making, bronzing, photography, or the laying of concrete. The metal worker will find in it formulas for the making of alloys, characteristics of materials, cleansing solutions, electroplating information, enameling processes, painting, polishing and soldering data.

TESTING AND GRADING FOUNDRY SANDS.—*Standards and Tentative Standards. New and revised edition. 152 pages, 6x9-in. Paper covers. Illustrated. Published by the American Foundrymen's Association, 222 West Adams St., Chicago. Price $3.00.*

Since the last publication of sand test procedure in 1928, certain revisions in the tentative and standard methods have been approved by the Committee on Molding Sand Research and have warranted this new edition. There are ten major divisions: method of sampling sand; preparation of sample; determination of moisture; permeability tests; strength tests (compression, bar strength, tensile, shear); fineness tests; mold surface hardness; chemical analysis; dye adsorption qualities; sintering test; and core tests. All the apparatus required is illustrated photographically, and in many instances working drawings are provided for shop construction. With brief, well arranged text and a detailed table of contents, reference to any phase of the subject is made easy. A bibliography is appended.

CHIP DISPOSAL PAYS ITS WAY

Kearney & Trecker have an efficient method of compressing chips and salvaging the oil. The equipment paid for itself in less than a year



Before this tangly mass leaves the chip crusher, it is concentrated to a density of 40 lb. per cu.ft.

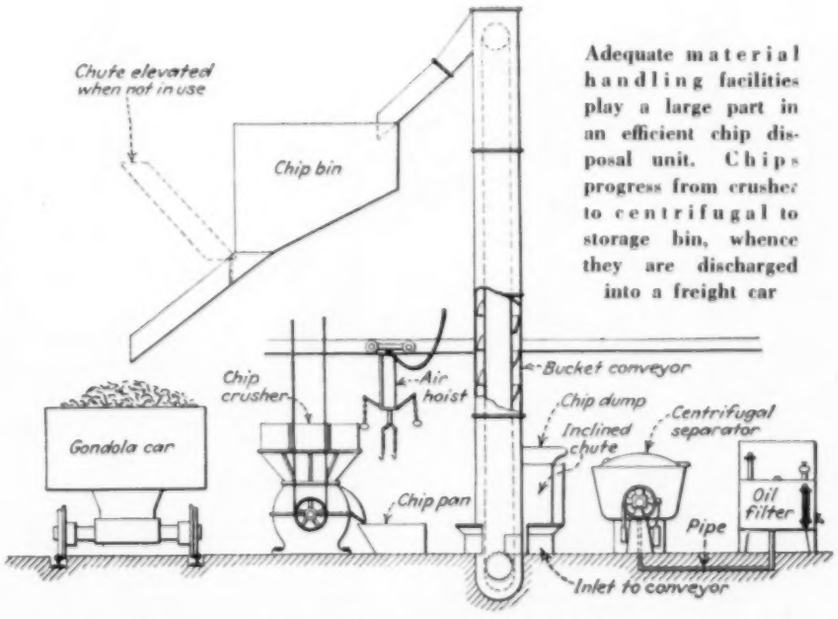
IN MANY plants, chip disposal is a nuisance, costing more than is received for the scrap value. The Kearney & Trecker Corporation, in Milwaukee, however, has been able to turn its screw-machine chips into a profit. Ordinarily these are the most difficult kind of chips to dispose of, as the oil must be extracted before they can be sold.

Savings made by installing proper equipment for crushing and drying the chips more than paid for the machines in less than a year. Crushed chips command a price of $2 to $3 more per ton than loose ones, and the oil extracted from them can be filtered and re-used. Besides, one man now does work formerly handled by two. Capacity of the plant is 8 tons, although ordinarily only about 5 tons of chips are produced daily.

In one corner of the screw machine department are a chip crusher, centrifugal oil separator, bucket elevator, 50-ton storage bin, air hoist, and oil-filtering unit, as well as a washer for finished parts. Chips coming from the screw machines are loaded into tote boxes mounted on caster rollers, and are pulled over to the crusher, which resembles an enormous meat chopper. The light, tangly masses are charged by pitchfork. A chute in the base of the machine discharges them into a bucket on the other side. The oil in the chips acts as a lubricant and reduces the power necessary to crush them. Chips leaving the machine weigh about 40 lb. per cu.ft.

Crushed chips are dumped into the separator with the aid of the air hoist, which is also used to lift the basket of oil-dry chips out of the centrifuge. This basket is dumped into a chute leading directly to the boot of the bucket elevator which deposits the chips in the overhead storage bin carried on a structural steel frame independent of the building. As soon as a load is available, a gondola car of 30- to 50-ton capacity is backed into the siding, which runs directly into the building, and is loaded from the discharge chute of the elevator.

The whole arrangement is concentrated in a limited floor space and adds to the orderliness of the shop.



Adequate material handling facilities play a large part in an efficient chip disposal unit. Chips progress from crusher to centrifugal to storage bin, whence they are discharged into a freight car

EXECUTIVE FORUM

Sales by Contest

AFTER several conversations with depression-minded friends, Bill Holland was glad to meet Jim Sargent in the lounge of the Manufacturers Club. Sargent was Sales Manager of the King Machinery Company and a confirmed optimist. Bill felt like talking to an optimist for a change.

"You look as though you'd just landed a hundred thousand dollar order," said Bill. "How do you do it?"

"I haven't landed it yet," Sargent answered, "but I have a plan on foot that should net many times that before the summer's over."

"Then you have the secret everyone's looking for," said Bill. "What's the scheme, or aren't you telling about it?"

"It's no secret at all," said Sargent. "Next month I'm going to start a sales contest. My plan is this: For a period of eighteen weeks, each week will be designated as a golf hole. The man with the highest sales during the week will be credited with a hole in one. The second man will score two and so on. At the end of the summer, the salesman with the low score will receive a hundred dollar prize. I'm going to call it the Hole High Contest."

"Is this your first experience in conducting such a contest?" asked Bill.

"Yes," said Sargent. "I don't claim the scheme is novel except for some of the details. But I've always had a hunch that I'd like to try it."

"Much as I dislike to dampen the enthusiasm of a young man trying to get ahead," said Bill, "I must say that sales contests are not all that is claimed for them. After all, selling is pretty serious business and must be kept on that basis."

"Not too rigidly," said Sargent. "Even a salesman should get some fun out of his work. A contest like this should appeal to a man's sporting instinct and add interest to the game. Besides, I expect some real results in the way of increased sales. I don't see how a little internal competition can help but stimulate increased activity."

"Are your men putting enough effort in their work to satisfy you now?" asked Bill.

"I can't really complain about their present efforts," said Sargent. "But like all of us, they're human, and a protracted period of reduced sales gets on their nerves."

"If a man is putting all his effort into his work, he may resent an attempt to crowd him by such obvious means," said Bill. "You'll probably find that a few of your force respond to the stimulus and that you'll get a temporary flurry of activity. But other companies have found that such benefits are only temporary. Even this slight advantage is usually paid for by diminished activity later."

"If the contest kills the seasonal summer slump in sales, I'll be satisfied," said Sargent. "If I'm any good at guessing, by fall, business will take care of itself."

"Don't you think a direct appeal to your force would be less childish and produce greater results?" asked Bill. "Sales contests may appeal to some types of salesmen, but you are dealing with men of pretty high caliber. Most of them have had a technical training and must be treated differently from chewing gum salesmen for example."

"Human nature is much the same underneath," said Sargent. "Most men enjoy a contest whether it's a horse race or a game of golf. When you add to it the element of incentive, it's certain to arouse interest."

■

What Do You Think About This Problem?

In some fields of merchandising, sales contests have become almost an established mode of reward. Companies in these fields use a continuous round of contests, and the prizes form a substantial portion of the income of the successful salesmen. For the sale of machinery, the use of contests is limited. From your experience, do you believe that machinery salesmen will respond to this form of incentive? Are contests of lasting value, or do they merely produce a "flash in the pan" followed by a reaction?

. . . Discussion

of Executive Problems

■

Dealer or Direct?

One dealer handles nationally advertised machine tools. His salesmen are capable and intelligent. They are given every opportunity to acquaint themselves with their customer's needs. At times they supplement their calls by bringing factory experts. If a customer needs new machinery, the dealer knows it and can advise his manufacturers weekly of business prospects in his territory.

If a customer wants service, the dealer is in almost daily communication with the manufacturer and can often tell the manufacturer what is wanted far better than the customer. Contrast this with a customer's trying to maintain the same intimacy of contact with about twelve manufacturers. The selling expense would be far more. Not one of the twelve salesmen would have as good a knowledge of the customer's requirements as the dealer. Can any one imagine the confusion which would exist if every manufacturer had direct representatives and all dealers were abolished?

—W. A. WALTER, *Purchasing Agent, Pneumatic Scale Company.*

Brain Fag

After working out in the shops for some time, I was transferred to the tool design department. The room was kept a few degrees warmer than the shop temperature. I enjoyed this new work, but nearly every afternoon, it was almost impossible for me to stay awake. The other fellows kept right on with their work. Whenever I felt this drowsiness coming on, I would lay some technical book on my drawing board, support my head with both hands and take a little nap. Sometimes I would take a walk around the shop. In about three weeks time, I became accustomed to the drawing room atmosphere and no longer feel dopey on the job.

—H. FORSCHNER.

Convenience or Confusion?

We already have a decimal system with figures like 0.46875. The draftsman or the machinist is a slave to his decimal equivalent table with its array of figures like automobile number plates. The metric system adapts itself to decimals naturally. If, after adopting the metric system, we should find engineers specifying $2\frac{5}{8}$ centimeters, the change will have cost more than it is worth. But it is natural to use common fractions in the English system and therein lies the complication. We attempt to use both fractions and decimals and so require a translation from one to the other.

The translation from inches to centimeters is the difficulty with the metric system. I once observed a machine worker who had spoiled an entire lot by translating 150 millimeters into $5\frac{5}{8}$ inches when he meant $5\frac{7}{8}$ inches. The reverse side of the scale he was using was marked very clearly in millimeters and would have given him the measurement directly.

Many of the advantages of the metric system could be obtained if decimal inches could be used. But this is too much to expect as the old fractions are too deeply implanted. Instead of 5.6 inches we would get 5.625 which is no gain at all. The adoption of the metric seems to be the only method of getting a true decimal system. Some day a generation of young men will arise who will force this through, standing the expense of the change in order to reap the benefits later.

—HARRISON G. BROWN, *Supervisor of Standards, Compton & Knowles Loom Works.*

Free Advice

The head of the personnel department should act in an advisory capacity for employees who seek assistance concerning outside matters. He should be well informed on matters which often concern the employees, such as mortgages, deeds, notes, and contracts. The supervisor does not execute these legal documents but only advises men as to the proper course to take and what conditions to avoid. The majority of employees are not well informed on legal affairs because as a rule, these things occur but once or twice in a lifetime. The advisor head should know reputable lawyers and physicians in the locality to whom he can safely refer the employee.

This whole system cannot be condemned because an individual is disgruntled at the outcome of his affairs. When a great majority of persons receive satisfactory advice, they will know that a complainant is to be expected periodically.

—FRED M. LINDAHL.

Buy Design?

After a machine is placed on the market, the secrets of design are at once public property. The manufacturer, being protected by patents, is beyond worrying about copied design. He is also protected to a large extent by the fact that he has special tools, jigs, and fixtures with which he can make replacement parts at a cost far lower than the purchaser of the machine. With this in mind, the manufacturer should not hesitate to submit full detailed drawings to the purchaser of his product.

To the purchaser of a machine, there are three distinct advantages in having these drawings on file. First, the purchaser may wish to make special fixtures, attachments, or alterations to suit some special requirement. This is simplified if the details are available. Second, while it is obvious that the purchaser cannot compete with the manufacturer in making repair parts, the delay in getting these parts may more than offset the cost of making them. Parts that do not require patterns or dies may be made and put to use before they could be re-

ceived from the manufacturer, thus saving days of valuable production. Third, after several years, the machine may become obsolete or the manufacturer may stop work on repair parts. In this case, the drawings are of great value to the purchaser. —Roy E. Peterson, *E. H. Hotchkiss Company.*

If a customer has a special machine built, he has a just claim for detail drawings as he has paid for it in the cost of the machine. When buying a builder's or dealer's regular line of machines, a customer has no right to demand any drawings other than those necessary to set up and adjust the machine. If the buyer should get a detail drawing, he should confine it to his own use. It is unfair to the builder to let anyone else have the drawing for any reason at all.

—Thomas M. Garry, *Yale and Towne Manufacturing Company.*

Cash or Check?

Both sides would gain if payments were made by check. It may require some program of education, a statement of the reasons at least, to sell the idea to the employees. Most business men prefer to pay and to receive payments by check. There is no good reason why wages should not be paid the same way if there are adequate banking facilities. Checks are safer than currency, more convenient, and furnish a legal receipt and record. There are many small hold-ups, thefts, purse-snatchings, and assaults committed against wage earners carrying home their pay. Many of these losses are not even reported; none are covered by insurance.

—H. J. Gustav Kopsch.

By all means, cash. The advantages of a checking system are all in favor of the company. In most communities, checks will be a hardship to the employee. Aside from the problem of identification at the bank, cashing the check in the store is something that cannot be done if one trades with the chain stores. If they trade with their corner store, then it won't be long before the entire neighborhood knows the pay that the individual receives, for there is no greater gossip retailing station than this. The protection to the employee is something that they do not wish, for all men like to think that they are well able to take care of themselves and resent any attempt at paternalism on the part of the employer. As far as influencing the spending habits of the employees by hoping to get them interested in banking, I hope that some day, employers will learn that it is man's inherent right to spend that which he earns, without help from others.

—Charles R. Whitehouse, *Standards Engineer, The Holtzer-Cabot Electric Company.*

Filling the Gaps

We decided to make some parts here even if it was necessary to add a little equipment. Some of the idle hands were very glad to co-operate by increasing their output on reduced piece-work rates. Our engineers are busy experimenting with new methods of tooling and production to aid in the making of former purchase parts. We do not attempt to make parts on which highly efficient sources of supply can outdo us, such as screws, nuts, and automatic parts, for our volume does not warrant such equipment. An advantage of home manufacture is the cutting of losses due to purchasing in quantity parts that afterwards have to be scrapped because of redesign.

—Charles H. Willey, *Superintendent of Manufacture, Hoyt Electrical Instrument Works.*

From the factory's angle, the accountant knows only one thing, and that is overhead. Floor space, light, power and machine charges as well as selling charges must be taken care of. The selling charge can be forgotten when we are making something for ourselves. I agree with the accountant however, that not much new money should be invested in making a standard product during times of slackness.

If we can come out with a whole skin or even sustain a small loss, it would be worthwhile to make a purchased article to keep the men together. Ordinarily one should figure thrice before competing with a specialist and heed carefully what the accountant has to say, although he may appear to be a pessimist. —J. C. P. Bode.

Promising Performance

No machine tool concern should be expected to guarantee day-to-day maximum output in the customer's plant, as it would be impossible to insure that instructions for running the machine were strictly carried out, that operator was thoroughly capable, and that he had available the right tools for the job. After a blueprint is sent to the machine tool concern to estimate the machining time, and a sale is made on the basis of that time study, if the operator fails to live up to the estimate, the buyer is dissatisfied. This could be avoided if number of pieces were sent along with the print and a careful time study was made and submitted with the proposal. If this were done, it would remove and prevent the misunderstanding that arises from time study from blueprint only. —Arthur Silvester, *Manager, The Iten Fibre Company.*

No Change

Every one admits that casual drifting from one factory to another is bad. However, we must not forget that even executives are inclined to drift somewhat. If a man does not change his job fairly frequently, how is he to gain extensive experience? It is out of the question, both practically and ethically, to attempt to bind a man down to his job by barring the doors of other factories against him.

If a man is valuable to a company, give him greater permanence by stating definitely that his period of hire cannot be terminated under say, a month. By this simple method, both man and company are protected one against the other. To this suggestion, it might be objected that the majority of operators would not like monthly payment. This is aside the question, since it is by no means necessary to make payment according to the contract time. Any agreement between factory groups tending to cut down the number of their employees would be bound to react on the community. —B. Brown, *London, England.*

IN ONE plant, one per cent of the employees had 25 per cent of the accidents. Additional evidence makes it clear that the training or control of repeaters is essential in prevention programs

IS ACCIDENT PRONENESS CURABLE?

W. DEAN KEEFER
Director, Industrial Safety Division, National Safety Council

NUMEROUS investigations in the metal-working and other industries seem to prove that a considerable percentage of all accidents is caused by relatively few employees. Some employees seem to be especially prone to accidents. These employees are called accident repeaters or accident carriers.

Other investigations indicate that many metal-working plants of today are having but few accidents. If we accept the theory that a certain percentage of industrial workers is especially prone to accidents, this means plants with few personal injuries have been able either to shift accident-prone employees to other departments or other plants, or to exert safety influence in the direction of the training of such employees.

As one example of accident control, the safety director of a large Chicago metal-working plant recently stated, "I have heard considerable talk from safety men in other organizations about accident repeaters in the metal trade industry: but we do not have accident repeaters in our organization." Another large metal-working plant in New York City reports that during a period of 15 months only twelve men have been injured twice, and no one has been injured three times. The safety director of the largest single manufacturing plant in the world, which employs about 29,000 men, states that the accident repeater is not a problem in his plant. During the month of November 1930, this plant had only five lost time accidents.

But these three plants are admittedly quite exceptional. They have much lower accident rates than the average for organizations in the metal-working industry. One specialist in the field of the study of personal responsibility in accidents, Dr. W. V. Bingham of the Personnel Research Corporation, has made the statement that, "where the number of observations recorded is sufficiently great to make the statistics reliable, it is usually found that from 10 to 20 per cent of the employees—those who have been called accident carriers—have about half of the total number of accidents."

One of the recent investigations in the field of accident-prone employees was made a few years ago by E. M. Newbold for the Industrial Fatigue Research Board of Great Britain. This study was made in twenty-two factories and included the accident records of about 7,000 men and 2,000 women for periods varying from three months to two years. A total of about 16,000

accidents was studied, though largely from the actuarial viewpoint. This report supplements a previous report which stated, as a conclusion, that the study, "not only shows by statistical proofs that in regard to accidents all workers do not start equal, in that some are more likely to suffer casualties than others, but also affords ground for thinking that the bulk of accidents may occur among a limited number of individuals having a special personal susceptibility to accidents." The investigator concludes, as a practical suggestion, that persons especially susceptible to accidents should be kept out of "risky occupations."

The reported experience of an industrial organization several years ago in the Pittsburgh district also seems to support the theory of accident-prone employees; or at least it would seem to indicate that certain employees were not well adapted to their assigned work. The company had about 4,800 employees, and during the year of the report a total of 974 of them, or about 20 per cent, had a total of 1,901 accidents. This represents an average of only about two accidents per employee who had accidents, but the tabulation of the number of accidents per employee looks quite different:

Employees Injured

No times	3,826	Ten times	4
Once	655	Eleven times	2
Twice	140	Twelve times	3
Three times	56	Thirteen times	1
Four times	51	Fourteen times	2
Five times	24	Fifteen times	2
Six times	10	Twenty times	2
Seven times	8	Twenty-three times	1
Eight times	6	Twenty-four times	1
Nine times	6		

A summary of that part of the tabulation which includes the employees who had more than five accidents each shows that 48 employees—or only about one per cent—had a total of 474, or nearly 25 per cent of all the accidents.

One of the best known modern experiments relating to the scientific and practical control of accident-prone employees has been conducted during the past few years with the employees of the Boston Elevated Railway Company under the personal supervision of Dr. C. F. Slocombe, Safety Advisor. This program was undertaken for the purpose of reducing accidents among motormen. Investigation indicated that 27 per cent of these motormen had 55 per cent of the accidents. An intensive study was made of all high accident men. This included a personal interview with each man by a psychologist, so he might form judgment as to the personality of the man; a period of observation of the man at his work by a specially trained instructor; a medical report on each man; data as to his age, length of service, experience; his accident record for the previous two years; a study of these accidents to find if they seemed to show any common factors as to type, time, place, and equipment; and the record of the individual concerning his observation of company rules, instances of insubordination, and his relations to other persons during his work. Following this preliminary investigation, a follow-up program was carried on for a period of twelve months with the 120 high accident men of one company division. This program provided that each man should be seen periodically by instructors, the superintendent, the psychologist, and the medical officer.

Some of the results from the Boston program follow: In January 1928, among 2,900 trainmen, there were 473 high accident men with an average of 71 accidents each. By November 1929, this number had been reduced to 181. In other words, 291 high accident men had been successfully treated. During the year preceding, and including 1927, collision accidents in Boston had been averaging about 650 a month; and during the first nine months of 1930, such accidents had been reduced to an average of 320 a month. Also, during this period a smaller number of men were discharged or disqualified than during like periods of the previous years.

A somewhat similar accident-prone study among motormen was begun on January 1, 1929 by the Cleveland Railway Company. Seventy-five of the 167 motormen of one station were graded as high accident men. The men were assembled at a meeting and later brought individually to the office for interviews. For each man a clinic report was worked out, based on these interviews and a medical examination. These men were assembled weekly in groups of twelve for conferences under the leadership of the superintendent of accident prevention. Actual accidents which had occurred to members of the group were analyzed by the men, the responsibility was fixed, and the possible measures for prevention were discussed. This special group of accident-prone men showed for the period of the first two months of the program a reduction of about 25 per cent in accidents.

As a comment, Clinton D. Smith, Superintendent of Personnel of the Cleveland Railway, stated: "I feel that we have proved the soundness of the idea of making a personal investigation into the habits and characteristics of the accident-prone men. We have demonstrated to our entire satisfaction that accident prevention is a matter of training, and that this training should be supplemented by educational activities."

Another interesting program has been the "accident clinic" of the Milwaukee Electric Railway and Light Company. It was begun in January 1929 as a conference of specialists to diagnose the individual cases of all high accident men. The conference board included representatives of the Claims, Medical, Welfare, Transportation, Safety, and Education Departments. During a period of six months following the clinical examination, a careful study was made of 33 high accident operators, and their accidents were reduced 81.5 per cent, as compared with the previous six months.

What Clinical Studies Show

During the year 1929, a clinical study of 54 men, representing 84 different accident cases, was made. The leading cause of these accidents was found to be "poor ability." The second most important cause was "attitude of the man." The third cause was "faulty operation habits." The fourth cause was "personality difficulty." The next important causes, in order were "home or financial worry," "inexperience," "slow to learn," and "poor adjustment to working conditions." As a result of the accident clinic for 55 cases, 30 cases were recommended for training and follow-up; 10 were at the conclusion of this period considered safe; 7 were referred to superiors for interviews; 4 were transferred; 3 were asked to leave the service; and 1 was referred to the medical department for examination.

In a summary of this work, Sadie N. Shellow stated in

the *Personnel Journal* that "the clinic has served to introduce the personnel point of view to a group of executives each of whom has been concerned with transportation from a different angle. It has helped to coordinate many diverse attempts of safety work. This served to broaden the point of view of each member of the clinic by making him familiar with factors other than his own. And finally, it has enabled the operators themselves to feel that they were getting a square deal and due consideration of their accident records. The clinic has become a permanent institution, and will continue to review the accident records of men who are piling up small accidents or having any unusual kind of accident."

From the viewpoint of constructive suggestions for dealing with accident-prone employees, the meaning of accidents has been well summarized by Dr. Edwin M. Chamberlain of Boston University. "The mental causes of accidents," he states, "may in general be classified under certain definite headings although every mental trait which man possesses is involved. Generally speaking, accidents occur because of faulty or careless observation sometimes due to defective eyesight of hearing, improper utilization of habit, defective or poor memory and reasoning ability, inferior intelligence and a generally slow reaction time."

Intelligence Level and Accidents

"A low level of intelligence is often accompanied by a slow reaction time, and this sort of person acts altogether too slowly when an emergency arises. The intelligent employee is constantly training himself in his work by asking himself what he would do if such or such a contingency should arise. The accident officer may aid employees by suggesting hypothetical situations. A man forewarned is forearmed. If a problem then arises which must be handled promptly to avoid an accident, his response has already been worked out and no delay is necessitated."

George E. Sanford of the General Electric Company, in an address before the Massachusetts Safety Council, summarized some methods which have enabled his company to deal effectively with accident-prone employees. "To make a study of your accident repeaters," he stated, "it is first necessary to set up a proper system, so the repeaters will be automatically disclosed. The system we recommend to our plant is that a record be kept in the hospital files of each employee."

The new employee is first given a physical examination, and thereafter all of his accidents are summarized on cards in an active file. If accidents are reported in close succession or of unusual form, an investigation is made, though effort is made not to discourage the employee from reporting minor wounds. Mr. Sanford further stated that a recent study had been made of lost time accidents at their Schenectady works over a period of thirty months, during which time 936 lost time accidents had occurred. Only eight men had had more than one accident, and none of these had had more than two accidents. A check-up of the type of man who had had repeated accidents showed that many of these men were not careless but were of the hustler type, with a tendency to push a job through to completion disregarding personal safety. They also found that insufficient experience caused but few accidents and that there were few machine accidents. When accident repeaters were found, the method of dealing with them included the following four steps:

1. Warning the employee as to his accident record.
2. Changing apparatus or method of doing work.
3. Transferring him to other work.
4. Dropping the employee from the payroll.

An investigation at one of their plants showed that an unusual number of accidents were occurring to employees whose name ended in "ski," and among others who had other foreign sounding names. From this, it was emphasized that care should be taken that safety instruction to foreign born employees should be actually understood. It is the policy of the company, when a middle-aged employee begins to have an unusual number of accidents, to make a check of his eyesight.

The safety director of a large Chicago metal-working plant states in reply to an inquiry about accident-prone employees: "We have not made a very close study of this phase of safety work, except that on several occasions we have noticed that an employee would repeatedly report to our dispensary for the same kind of injury occurring in the same manner. For instance, an employee in the machine shop may repeatedly hit the first finger of his left hand when doing the same kind of work. The only thing we have developed from following out cases of this kind is that we have a man wrongly placed in our plant; that is, a carpenter working as a blacksmith or doing some other work not particularly suited to him."

An official of another large Chicago plant, which has made a splendid safety record, states that it is the policy of his company to follow up accident repeaters by individual letters from the central record office to the superintendents under whom these men work. Collectively these reports prove that accident-proneness does exist and that most cases may be corrected by intelligent treatment.

■

Licked at the Start—*Discussion*

WILLIAM BRYCE
Sheffield, England

YOUR editorial in Vol. 73, No. 17, bearing the above heading, indicates that thousands of dollars are wasted daily by work which ought not to be necessary, and that supervisors should continually question themselves whether various operations are a legitimate part of the job, is much nearer the truth than is generally imagined. It is because it is so true concerning much work I have done, and so difficult to force home to those concerned, that I comment upon it. Today, as in the past, the writer is bang up against it continually. When jobs take a long time and prove expensive, the usual course is to blame the mechanics for being slow. This does not touch the root at all. Although some supervisors deal with the matter intelligently, many do not. Strange though it is, neither complaint nor suggestion prevent the same trouble recurring next time the job comes along. On much work, mostly of the expensive kind, but often on repetition work, fifty per cent of the time might be saved. An intelligent mechanic, with proper scope, could detect the source of trouble, get it removed, and thus save the thousands of dollars referred to. One might go into details, but a word to the wise ought to be enough and to spare.

The Foreman's Round Table

PITILESS PUBLICITY

ED MADE a bee line for the gate when the whistle blew in order to avoid his friend Al. His effort was futile, however, because Al, anticipating his intention, beat him to it and was waiting at the gate. As Ed came along Al hailed him with, "What's the big rush tonight, fella?"

"Oh, nothing in particular," answered Ed, "I just wanted to get home early and do a little digging in the garden."

"Yeah, I expect so. You hurrying toward work is a joke. I'll have to tell that one to your wife."

"My wife can think up enough things to harp on without you telling her anything. That reminds me, she asked me to do an errand for her. Good night, Al."

"Not so fast, big boy, not so fast. I'll walk along with you, I want to talk with you about that item on the bulletin board about spoiled material, that you have been trying so hard to avoid. How about it?"

"Cut it, Al. I've been rawhided about that all day, and I'm sore. I want to get away from it."

"Don't let it get under your hide. You'll have your chance. You kidded me because one of my machines had to be overhauled after it had not been oiled for some time, didn't you?"

"Sure I did, but that was something else. I can't laugh at my own troubles like you can. You look easy, but you're hard boiled. I appear to be hard boiled, but things get under my hide."

"I know they do, Ed. You're one of those armadillo people who use a hard boiled exterior to defend a soft heart. You're always in opposition because you fear you may seem to be influenced too easily. That's the reason I love you like a brother, you big bluffer."

"Thanks, Al, that makes me feel better. But do you honestly think it is a good idea to broadcast a man's faults like we are doing."

"No, not a man's faults. But a department's shortcomings, yes. Publicity is the most powerful agency for good that we have. Millions are spent every year to get it, and as many more millions are spent to avoid it. If wisely employed it is a powerful incentive to good management. One of the founders of scientific management said that when we had found some way of measuring the efficiency of a manager by the same yardstick we use for measuring the efficiency of a man, we would have much better management. I believe that if the mistakes of management had been visualized on a bulletin board where all might see and judge, we might not have had the upset in business that we have. It is almost certain that we could not."

"That's all right, but Williams is not going to broadcast his own mistakes or those that the old man makes. So why broadcast my troubles?"

"Are you dumb, or perverse, Ed? The fault is not yours, personally; but you stick your chest out when the department gets credit and you've got to take the responsibility for its discredit. It's true that if the mistakes made by everybody were posted we would have fewer mistakes, but we have not yet arrived at that stage. It is surely coming though."

"That may be all right, but it will cause lots of ill will."

"Ed, did you ever see that cartoon called, 'Events that led up to the crime?' Well, you mention ill will to me again and you will be able to appreciate its humor. Is a spoiled child sweet tempered? Do the men in this square, clean shop crab less than the men in some dirty little shyster dump? Not on your life. We can have either crabbing and poor management, or crabbing and efficient management, it depends on whether the man in charge has both efficiency and guts, or neither one."

"Well, as I said before, I guess I'll go home and work in the garden. I need some fish worms."

Is publicity the cure for carelessness and inefficiency? Are there any more effective methods? Would executives object to being judged on their efficiency and productivity?

Suggested by Wm. J. Owens,
Foreman, Newport Rolling Mill Company

▸ ▸ ▸ Discussion of Former Topics

Gilding the Lily

Ed is dead wrong about his men buying tools. Few mechanics have enough good tools. I should encourage any man who talked of buying tools. The man who takes pride in a collection of good tools is usually a steady, dependable workman. The apprentice who spends his meager funds for tools will become the skilled workman of the future.

Some may say that they have seen skilled machinists come into a shop with only a few tools in their vest pockets and handle any job put up to them. Yes, but how long did they stay? Men of this type are usually floaters and seldom stay long in one shop.

Few men on production jobs buy fine measuring tools. If they do, and make their work "too good," why not put them in line for a job where fine measuring is required, such as the grinding department or the tool room.

—HERBERT M. DARLING.

Bad Debts

There is no sentiment in adopting a hands-off policy towards employees' private affairs. When a prospective creditor writes or comes in to ask for the average earnings of an employee before trusting him for goods it is O. K. to give the information. It is probably wise to give personal impressions as to his managing ability at home and with his finances. Far better to caution a tradesman before he trusts a slow paying employee than to be the club to make the debtor "cough up."

When certain low-grade high-pressure, salesmen, dealing with the lesser paid workers, learn that we don't give a continental about their troubles, but are interested in protecting our own men, there will be fewer submarginal buyers favored with their alluring talks.

Any man who thinks he might be taking advantage of the firm's attitude is apt to have a blank handed him on some pay day. A personnel man who tries to horn in on any collecting proceedings should be stepped on, pronto. On rare occasions an honest employee is tricked into phoney buying. If he appeals to his boss, the company should take such means as it sees fit to protect him. The dead beat is always open to the garnishee process wherever he is working.

—E. E. GAGNON, *Mechanical Superintendent, Raybestos-Manhattan Inc.*

The Tower of Babble

There are many towers of babble other than that of clashing national speech and mentality. Horse sense is not the monopoly of any class or nation, nor is cussedness. There are some men who seem to be constitutionally unable to co-operate with anyone. Where they are, there are all the undesirable qualifications of a bear garden. If such men are segregated, so that they attend to their own particular tasks without reference to the work of other men, they turn out excellent results. When, however, it comes to putting them into harness they prove themselves simply impossible. They can work solo, never in harness. They spoil any choir or orchestra: they queer any pitch.

—W. R. NEEDHAM, *Stafford, England*

The Cost of Quality

Contracts in the mechanical field, as in other fields, are awarded on a competitive basis. The shop that can do the best work for the least money will get the contract. Once the contract is awarded the customer not only expects, but insists, that every component or assembly shall be as per specifications. So, in the case of the automobile manufacturer, he should expect nothing but good parts. A percentage of defective gears found in each shipment would necessitate additional inspection on the receiving end; otherwise, defective gears will get into the machine. No one wants to buy a machine with defective parts in it.

—GEORGE BELBES, *Teletype Corporation.*

No Exceptions

All reasonable means should be used to retain and satisfy good men. But, unfortunately, ambitious young fellows are often blind to their highest interests, and only bitter experience can teach them. The writer is past middle age, but, when young, was just as ambitious and headstrong as Lacy, and acted similarly. I left a good secure job as workman for that of foreman, but later experience caused me to regret it deeply. I found that foremanship often causes misery instead of happiness, unless one is especially adapted for the position, and that after a man has sold his life and soul to a firm, he may be cast off without the least compunction. My advice to such as Lacy is, "stay with the firm where you are valued; do not thrust open a door into foremanship, but wait until some firm thrusts you into the position; then you have good prospects of success."

—WILLIAM BRYCE, *Sheffield, England.*

Tolerances

When a plant is lining up a valuable job, the manager should know about it. He should be interested enough in it to concern himself with the manner in which it is being done. He should know that intelligent consideration of tolerances requires three points of view. The manufacturing men have a good idea of the uniformity with which they can obtain certain dimensions. They are apt to be optimistic in this respect, however, and the opinion of the inspectors is valuable in fixing the practical limits of workmanship that have actually been attained with the existing personnel, equipment, and allowances for detailed parts inspection. The views of

the inspectors are also valuable in checking the engineer's conception of necessary fits and clearances for rapid assembly and proper functioning after assembly. The engineers, however broadminded they may be, are charged with the maintenance of high standards and will be affected in their decisions by the knowledge of tolerances used on drawings in the past—oftentimes without knowledge of the mill's actual interpretation or observance of these tolerances. Obviously, with three distinct activities, engineering, inspection, and manufacturing involved, some outside controlling force must secure their general agreement on the subject. —R. A. JOHNSON, *Wickwire Spencer Steel Company.*

Trying His Wings

If the general manager says to a mechanic, "I can see you have the brains and experience to run a business of your own. I think you will make good. If you care to make a start, I will give you a year's contract that will help you to get on your feet." Then the first question the mechanic should ask himself is, "Is the general manager disinterested?" In any case he will be wise to go into the question of capital expenditure and then go to an accountant for advice. He should look around to see what other work he stands some chance of getting without spending his time begging for orders when he ought to be managing the business. Also he will not bank on any work he does not hold a contract for.

—H. J. BURNHAM, *Birmingham, England.*

Off Again, On Again

Williams' proposed blanket rule discouraging the practice of rehiring is undoubtedly the result of an accumulation of griefs suffered in the past through such practice.

Accurate statistics compiled by the personnel department of a concern with which I was at one time associated disclosed the fact that 67 per cent of the "quitters" made reapplications for jobs within three years. Of the 25 per cent who were rehired (only the skilled workers were rehired) 45 per cent again quit within the following 2½ years.

Workers who have been rehired form gigantic opinions of their particular skill and importance to the industry and are the hardest men in the shop to discipline.

Unless the company's policy of frowning on rehiring is made apparent to the worker he will jump at every opportunity that comes his way, knowing that if the worst comes he can always return to his former company. —H. S. DEELY, *Planning Engineer, Johns-Manville Company.*

The Cost of Quality

If the customer receives 100 per cent good gears, this is exactly what he is paying for, but it is not a guide to the number of gears that have been rejected during manufacture. The usual percentage allowed to subcontractors for machining on such work as aircraft components during the war was 3 per cent. If this was exceeded, the cost of the additional material to replace same was charged up to the contractor.

Where the percentage of parts rejected by a customer is small it points not only to good machine shop methods, but also to efficiency on the part of the inspection department. In estimating the cost of manufacturing components, consideration is always given to the limits specified. If these are closer than is really necessary the customer alone is to blame if the cost is in excess of what it would have been had the allowance been greater.

A machine shop accustomed to the production, on repetition lines, of high-class interchangeable work where the total tolerance on ground shafts for ball race fits would be 0.0004 in. providing the equipment is up-to-date and maintained in good condition and the labor is properly trained, will work at maximum production rate with a scrap percentage as low as 1 per cent. On the other hand if a contract shop were to take an order for such parts it would not expect to obtain the same efficiency or as low a percentage of rejects.

—W. L. WATERHOUSE, *Staffs, England.*

Tolerances

There is an old saying that men make laws, but observance of the law makes men. Tolerances, then, may be said to constitute the laws by which the finished product stands or falls.

In the case cited, the Brooks and Sargent people stand convicted by the rules they had set up, and as we are informed that obsolete machinery played no part in their undoing, the obvious deduction is that human element was at fault.

Were I asked to apportion the blame for the rejection of the finished parts, I would unhesitatingly name the inspection department, because any variance from the approved tolerances should have been detected and the defective parts withheld from the assembly line. Had they rigidly inspected the first parts and refused to accept work that did not conform to the blue prints, the faulty workmanship could have been traced to its source.

The unchecked error has a habit of multiplying itself, especially where dimensions are concerned. Therefore, inspection must play an important part in mass production if a high standard of quality is to be maintained.

—ROBERT S. ALEXANDER, *Universal Winding Company.*

Age and Its Compensations

The custom of an industrial organization setting a maximum wage rate that cannot be exceeded, for any one of a class of employees, regardless of skill, age, experience, or seniority, is not one to inspire respect and confidence between employer and employee. Neither is the cutting of piece-work rates.

Seniority should be recognized to a certain extent, but in the final analysis the value of a man to an employer lies in the amount of work he can produce in a given time. If he has the skill, knowledge, and experience to produce more than the average, why should he not be rewarded by an increase in his hourly or daily rate, as the case may be? I think Al hit the nail on the head with his remark, "A man should be paid on the basis of what he is worth to the organization, not of what men working around him get or how old they are."

—GEORGE R. MILLER, *Head Millwright, Pacific Lumber Company.*

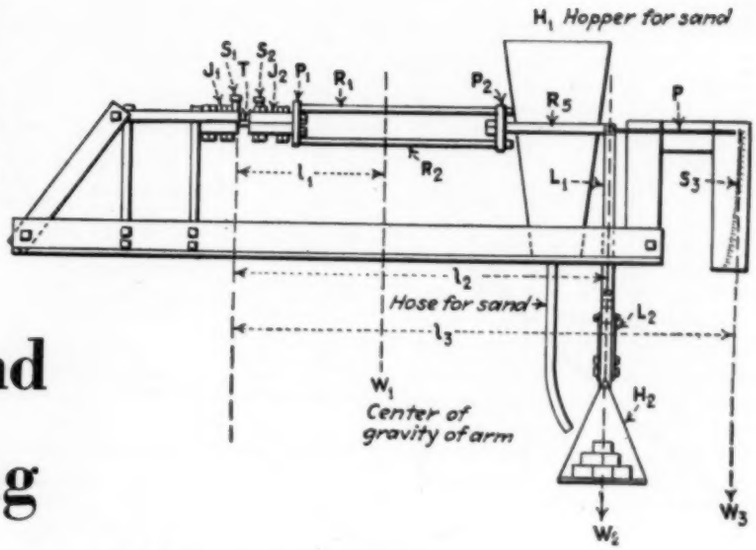


Fig. 4—Diagrammatic sketch of bending machine employed to get comparative data on the toughness of high-speed steel after hardening. The specimen is clamped in the jaws and bent until destruction by loading weights on the pan. The deflection of the pointer is measured on the scale at the right

Selecting and Hardening High-Speed Steel—II

ALFRED HELLER
President,
Hercules Electric Steel Corporation

THE PREVIOUS article discussed the hardening characteristics of five representative high-speed steels with respect to hardening temperatures and time of soaking. It showed that a temperature of 2,250 deg. F. and a soaking period of 1 min. produced a hardness equal to that produced by heating to 2,350 deg. and quenching directly. It showed, also, that the cobalt steels investigated harden more rapidly with temperature than do the tungsten steels. The present article will deal with the toughness obtained when lower hardening temperatures are used with short soaking periods.

To determine the properties of high-speed steel after hardening, the special bending machine illustrated in Fig. 4 was built. By its use the elastic limit and angle of deflection or bending at rupture can be determined. Specimens are subjected to bending as encountered in the majority of cutting tools. Samples of steel measuring 0.375x0.375x3 in. were hardened, tempered, and then ground to 0.355x0.355x3 in. to insure removal of all soft skin, even though heated to 2,425 deg. F. This specimen, known as sample T, is then clamped in the tool-steel jaws J_1 and J_2 by means of setscrews S_1 and S_2. The test piece is so placed that it protrudes 1 in. into each jaw, and the distance between the jaws is set by gage to precisely 1 in. As will be noted, J_1 is rigidly supported, whereas J_2 is part of the bending system. It is attached to plate P_1, which forms the end of a deep-section beam acting as a stiffener member to prevent error in the indicated angle of deflection. This deep-section beam comprises the aforementioned plate P_1, the four connecting rods, R_1 to R_4, and the plate P_2. From P_2 projects the rod R_5 carrying the pointer P, which indicates the pointer deflection in inches. Attached to R_5 is the weight pan, which can be removed in favor of a box to contain sand. The sand can be introduced from the separate hopper through the hose and offers a means of loading the system at a uniform rate.

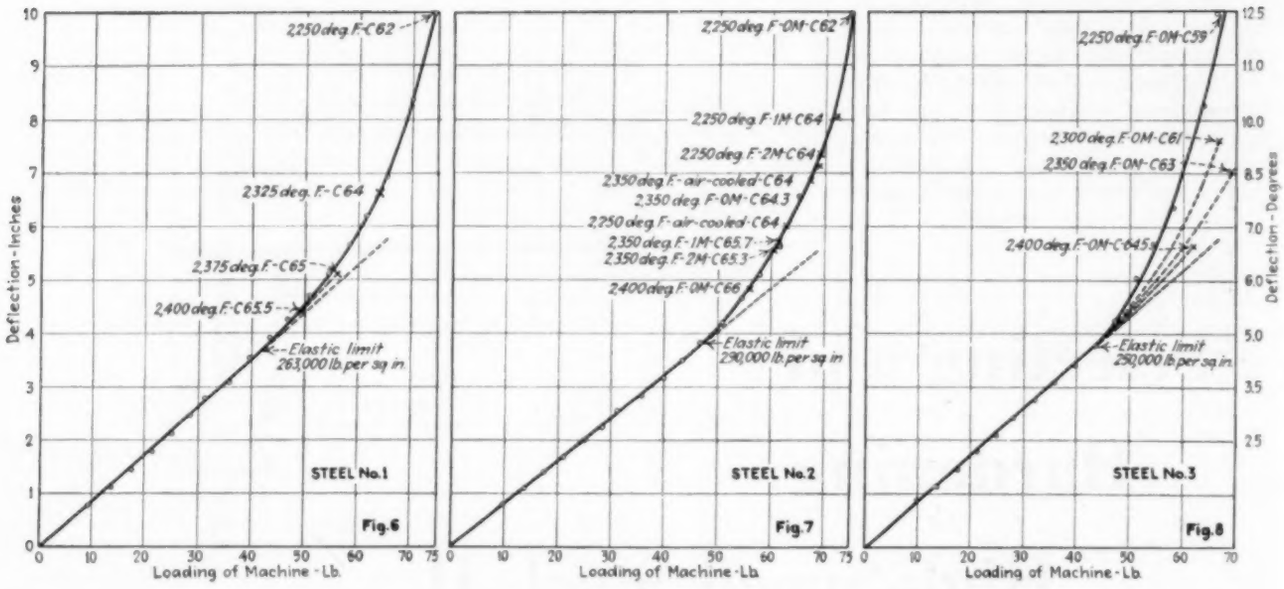
Obviously, in this machine the sample T is stressed by the combined effect of several moments. The first moment is caused by the weight of the bending arm acting through the center of gravity of this arm. This moment will be known as W_1l_1. The second moment is caused by the weight of the pan and supporting link, plus the weight of the sand or weights employed. This moment will be known as W_2l_2. For convenience these moments will be referred to the pointer scale, the moment arm being l_3. The equivalent moment is:

$$W_3 = W_1 \frac{l_1}{l_3} + W_2 \frac{l_2}{l_3}$$

It will be used for calculating the elastic limit of the samples, as shown by the graphs.

For all loadings up to the elastic limit the strain will vary in direct proportion to the stress. The points thus found will lie in a straight line, which should pass through zero deflection for zero loading. In operating the machine, however, there will be a zero correction for each sample tested because of variations in the clamping of the setscrews S_1 and S_2. To determine this correction any two points within the elastic limit are plotted and the line joining them produced for zero loading. If this line does not pass through zero deflection, the correction found must be used for plotting all deflections up to the point of rupture for the sample.

In operating the machine two methods of loading are employed. In the first method steel weights weighing about 5 lb. each are placed in the pan H_2 and the reading for the deflection obtained. Then a second test is made by substituting the sand box for the weight pan. Sand is applied at a constant rate. Beyond the elastic limit, and up to the breaking point, the time of application has an effect. If the curve obtained with the first sample



be now used and extended, if necessary, to meet the point of rupture as determined by the second sample, a more accurate determination of the maximum deflection of the steel is possible. The subsequent curves shows that the machine is rigid enough not to introduce error from bending of the components.

For convenience the table listing the constituents of the five representative steels is reproduced from the first article, as seen below:

TUNGSTEN STEELS

	C	*Si*	*Mn*	*W*	*Cr*	*V*
No. 1	.68	.30	.20	18	4	1
No. 2	.78	.30	.20	18	4	1.5
No. 3	.58	.30	.20	18	4	1

COBALT STEELS

	C	*Si*	*Mn*	*W*	*Cr*	*Co*	*V*	*Mo*
No. 4	.72	.30	.20	17.25	4.00	4.50	1.00	.50
No. 5	.78	.30	.20	18.00	4.00	6.75	1.85	.75

In Fig. 6 is shown the toughness characteristics of the most frequently used type of tungsten high-speed steel; that is, steel No. 1. This characteristic is very similar to that of steel No. 2, as shown in Fig. 7, but it will be seen that the elastic limit is slightly less and that deformation takes place slightly more rapidly.

The toughness characteristics of steel No. 2 is shown in Fig. 7. It was found that up to the elastic limit the slope of the curve was the same irrespective of the hardening temperature over the range investigated. The elastic limit was found to vary slightly with the hardening temperature over the range from 2,250 to 2,400 deg. F., but so little that only one curve is used for all temperatures. However, the deflection beyond the elastic limit varies considerably. For example, with a hardening temperature of 2,400 deg. F. and zero time of soaking, a deflection of only 1 deg. beyond the elastic limit caused rupture, whereas at 2,250 deg. F. with zero time of soaking, the deflection was 7½ deg.

The effect of soaking is also clearly shown. When the sample is soaked for 1 min. at 2,250 deg. F., the hardness increased from Rockwell *C62* to *C64*, and the total deflection is reduced to 10 deg. Two minutes of soaking at 2,250 deg. F. gave a further reduction to about 9 deg.; 2,350 deg. for 0 min. soaking gave about 8½ deg., the same temperature at 1 min. soaking, 6¾ deg., and 2 min. of soaking, 6½ deg. At 2,350 deg. F., both the oil-quenched and air-cooled samples showed about equal toughness. It becomes evident, therefore, that soaking steel from 1 to 2 min. at 2,250 deg. to obtain Rockwell *C64* gives a toughness as great or slightly greater than for heating to 2,350 deg. F. without soaking to obtain the same hardness. Since toughness is indicated by the ability to deform beyond the elastic limit, it is shown by this curve that high-speed steel when hardened at 2,400 deg. F. is comparatively brittle, whereas when soaked for 1 to 2 min. at 2,250 deg. F. it is quite tough. The difference in hardness for steel held at 2,250 deg. for 1 min. and that of steel not soaked at 2,400 deg. F. is approximately 1½ Rockwell *"C"* numbers. Considering the service results, the best combination for hardness and toughness is obtained by soaking steel No. 2 for about 1 to 2 min. at 2,250 deg. F.

The toughest of the high-speed steels of the tungsten type is steel No. 3, as shown by Fig. 8. It will be noted that overheating is much less harmful for this type, when considering toughness, than with steels Nos. 1 and 2.

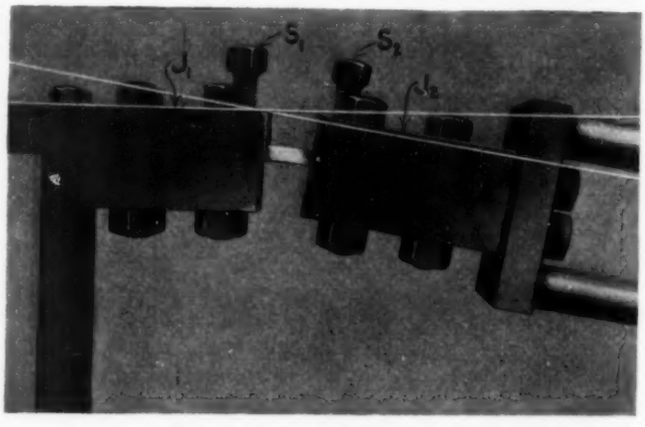
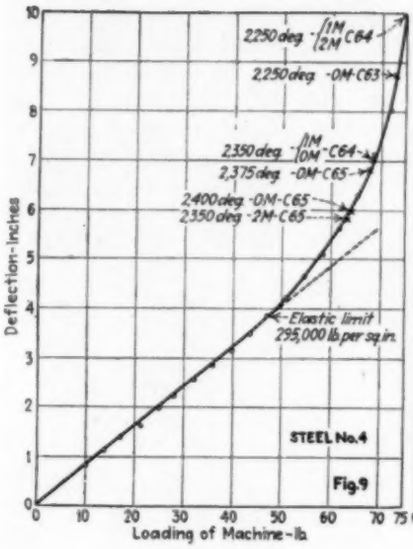


Fig. 5—Close-up of specimen in the clamping jaws of the bending machine. This specimen has been bent through an angle of 8½ deg., although the hardness is Rockwell C65


2250 deg. - 1M 2M C64
2250 deg. - 0M-C63
2350 deg. - 1M 0M - C64
2,375 deg. - 0M-C65
2400 deg. - 0M-C65
2350 deg. - 2M-C65
Elastic limit 295,000 lb. per sq. in.
STEEL No. 4
Fig. 9
Deflection - Inches
Loading of Machine - lb.

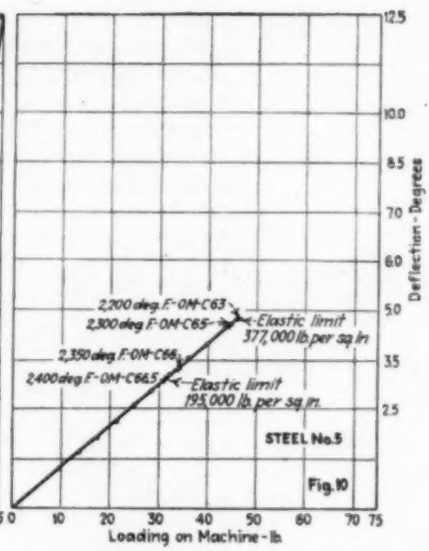
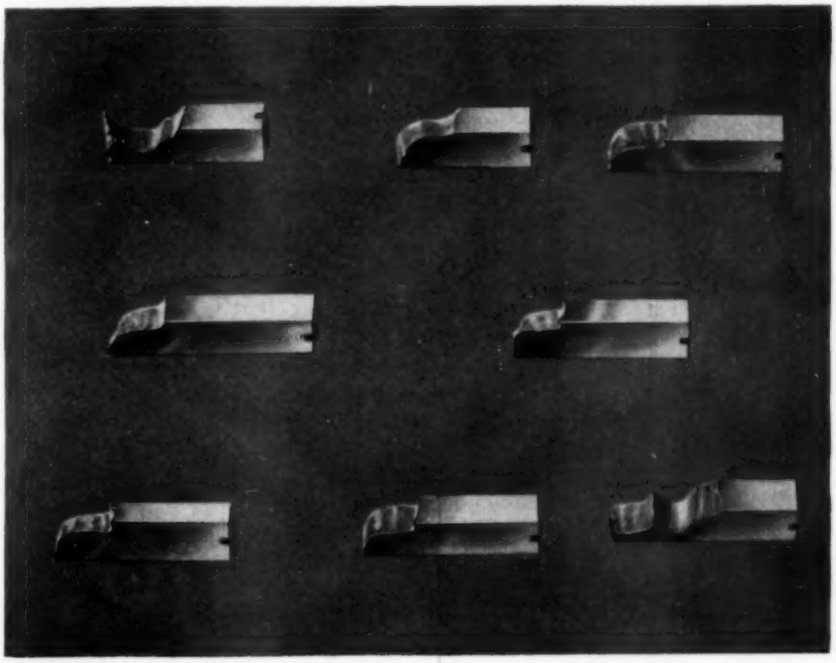

2,200 deg. F - 0M-C63
2,300 deg. F - 0M-C65
Elastic limit 377,000 lb. per sq. in.
2,350 deg. F - 0M-C66
2400 deg. F - 0M-C66.5
Elastic limit 195,000 lb. per sq. in.
STEEL No. 5
Fig. 10
Deflection - Degrees
Loading on Machine - lb.

Fig. 6—With increase in hardening temperature, the toughness of Steel No. 1 falls off rapidly. All samples tested have not been soaked. The point of rupture for each temperature is indicated by x. Fig. 7—Maximum toughness for Steel No. 2 is achieved with 2,250 deg. F. and soaking for 1 or 2 min. Fig. 8—Overheating is much less harmful with Steel No. 3 than with the other tungsten high-speed steels. Fig. 9—Less effect is produced by overheating Steel No. 4 (standard cobalt) than the standard tungsten high-speed steels. Soaking also has less effect. Fig. 10—Brittleness is very evident in Steel No. 5 (high cobalt), the elastic limit coinciding with the ultimate strength



Typical bending fractures produced in testing high-speed steel on the machine described

The elastic limit is lower and deflection for a given loading is greater.

Fig. 9 shows the toughness characteristics of standard cobalt high-speed steel. The toughness is less affected by soaking at the hardening temperature or by overheating than the straight tungsten high-speed steels. For example, two test pieces when soaked for 1 or 2 min. at 2,250 deg. F. show slightly greater toughness than one test piece not soaked at 2,250 deg. F. One sample not soaked at 2,350 deg. and one soaked for 1 min. developed the same toughness, whereas the one soaked for 2 min. showed the same toughness as another not soaked at 2,400 deg. F. The Cobalt No. 4 test pieces which were soaked for 1 or 2 min. at 2,250 deg. F. did not break when bent through an angle of 12½ deg. After removal from the testing machine, they showed a permanent set of more than 2 deg.

Although this type of cobalt steel is usually considered more brittle than a straight tungsten steel, it becomes evident that a steel with a Rockwell hardness of *C*64, capable of bending through an angle of 12½ deg. without breaking, cannot be considered brittle. The previous trouble with this steel was apparently due to the higher hardening temperatures employed, and because the steel is more apt to develop rolling seams and hardening cracks. It was found on the machine employed in these tests that a seam that reaches only to a depth of $\frac{1}{32}$ in. or less will reduce the toughness and strength about 66 per cent. Some of these seams are extremely difficult to discover.

During the past year many thousands of toolholder bits were made of steel No. 4. During this period, and using the type of heat-treatment recommended, only three bits were found to be brittle. One showed a seam caused in the cold drawing of the bar stock and the other two showed the rather high Rockwell hardness of 65.5. Probably these two bits were soaked too long or at too high a temperature. When a hardness of *C*64 is obtained by soaking for 1 to 2 min. at 2,250 deg. F., there is no cause for complaint in regard to the brittleness with this type of cobalt steel.

Cobalt steel No. 5, as shown by Fig. 10, is decidedly brittle. The elastic limit and ultimate strength coincide. The great hardness obtained with this steel, as shown by Fig. 2 in the first article, accounts for its popularity in machining very hard and tough alloy steels.

Surface conditions as affected by time and temperature are of vital interest. Samples of steels Nos. 1 and 4 were given a slow soaking heat in a gas-fired furnace to determine the amount of decarburization and volatilization under good operating conditions. They were tested for hardness before grinding, and the amount

In the third and final article, the technique of tempering high-speed steel and its selection for various purposes will be discussed.

of grinding then determined to reach steel of maximum hardness. The table below gives the results:

	Temperature	*Depth of Decarburization*	
		Soaked 0 Min.	*Soaked 2 Min.*
Steel No. 1	2,250 deg.	0.000	Less than 0.001 in.
Steel No. 4	2,250 deg.	Less than 0.002 in.	Less than 0.002 in.
Steel No. 1	2,350 deg.	0.000	Less than 0.002 in.
Steel No. 4	2,350 deg.	Less than 0.002 in.	About 0.006 in.

The bad effect on surface conditions of soaking a cobalt steel at 2,350 deg. F. is clearly shown. With poor heating conditions this decarburization can easily amount to 0.015 in. At 2,250 deg. practically no grinding was necessary, even with the cobalt steel. It then becomes apparent again that for the standard tungsten and cobalt high-speed steels, the best heat-treatment is to heat them to 2,250 deg. F., followed by soaking for one to two minutes. With this treatment a hardness of *C*64 is consistently obtained, together with toughness and very little soft skin.

Short Cuts in Die Making—*Discussion*

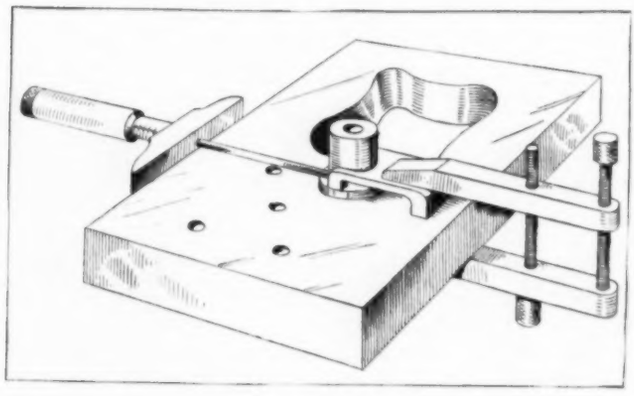
CHARLES E. GALLS
Tool Estimator, Ford, Bacon & Davis

IN VOL. 74, page 203, William C. Betz, explains three methods of making elongated piercings. I have used two of these methods for a number of years and have proved their worth in initial cost and maintenance. There is still another method which I ocasionally call forth to vie with the use of modern jig boring machines. Credit for this rightfully belongs to an old Swedish toolmaker, known for his accurate and speedy work, under whom I had the good fortune to serve.

The first requisites are a set of flanged bushings, hardened and ground on the outside diameter and lapped inside, and a corresponding set of gun drills or reamers, ground and lapped to 0.002 in. under standard drill rod sizes. For a start, six sizes will serve: 0.248, 0.310, 0.373, 0.435, and 0.623 in. This set of six reamers and bushings will cover a wide range of work and may be added to from time to time.

The toolmaker should use extreme care to see that two sides of the die block or jig are square before starting to lay out for rough drilling, the first operation. After laying out, the toolmaker center punches and rough drills the holes to within $\frac{1}{32}$ in. of the line. Next he places his bushings, using a micrometer depth gage for setting them, and gun reams to size.

This method will be found to be correct within plus



or minus 0.0002 in. To illustrate its simplicity, a five hole layout of a blanking die using bushings is compared to the same layout using buttons. It will be noted that only three operations are essential for the former method as against six for the latter. The time required to prepare the die block up to the point of layout is the same for both methods.

Bushing Method	
Operation	Time in Hours
Layout	Same
Center punch and drill	0.333
Place bushings—5 holes	1.66
Gun drill or ream—5 holes	0.416
Total	2.415
or 2 hrs. 25 min.	

Button Method	
Operation	Time in Hours
Layout	Same
Drill 5 holes for buttons	0.416
Tap 5 holes for buttons	0.833
Place 5 buttons	1.25
Strap on lathe face plate	0.333
Indicate and drill 5 holes	1.333
Total	4.165
or 4 hrs. 10 min.	

The question may be raised as to why comparison with a jig boring machine is omitted. The die illustrated is not a jig boring job. I am satisfied that a jig borer could produce no such saving especially where the holes are to be bottomed for bushings.

■

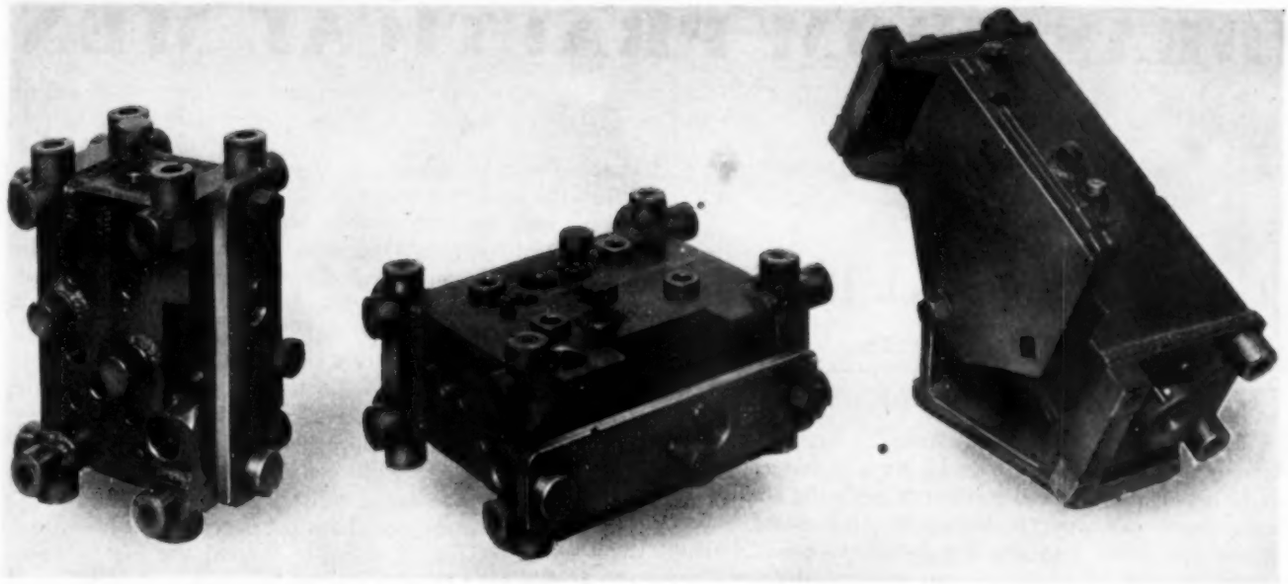
When Forging Was Young—*Discussion*

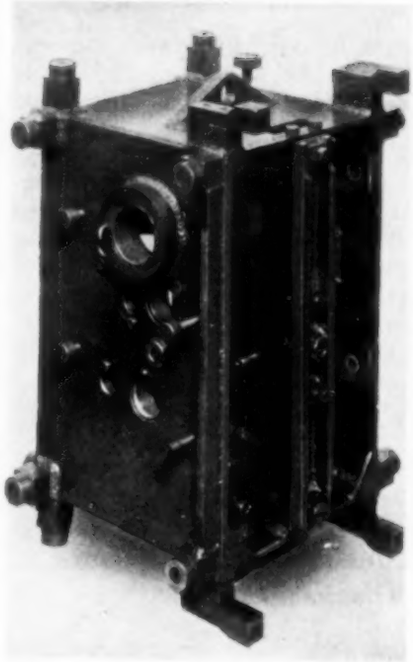
F. P. TERRY
Belfast, Ireland

ON PAGE 469, Vol. 73, Mr. Lord informs us that the steam hammer was invented by John Nasmyth, and that Germany was the first to utilize his design, whereas it was invented by James Nasmyth, proprietor of the Bridgewater Foundry, Manchester, England, and first used in the Schneider Works, Creuzot, France.

How this came about provides an interesting story, fully described in the *American Machinist* about eighteen years ago. In short, M. Bourdon, manager of the Schneider Works, paid a visit to the Bridgewater Foundry, and Mr. Nasmyth being absent, his partner produced his sketch book, which was open to everyone, showing the design of the steam hammer, which M. Bourdon sketched out there and then, after receiving permission to do so. Very soon a steam hammer was made and set to work in France, and, Mr. Nasmyth arriving there some time later, saw, much to his surprise, his dream actually fulfilled. Returning home as quickly as possible, he secured his patent and commenced its manufacture at once, and very soon added considerably to his fortune. It may also be added that the 14-in. shaft referred to by Mr. Lord by word and picture was not made. A new design was submitted and a screw propeller fitted to the ship.

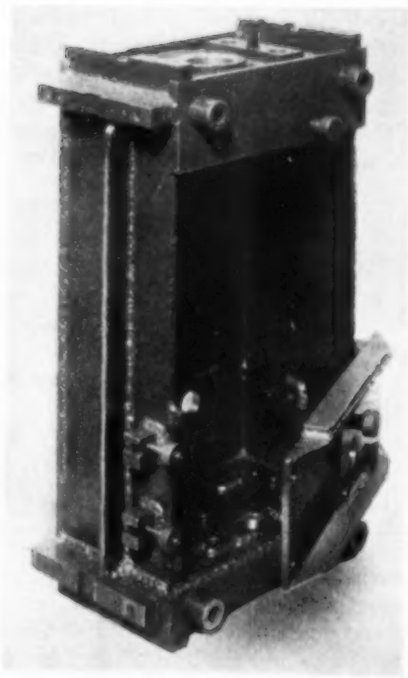
The steam hammer was originally designed practically as it is found today, which any reader can verify by referring to the old *American Machinist* mentioned, which reproduced Mr. Nasmyth's original sketches. He had many other inventions, one, known as "Nasmyth's Steam Arm," the forerunner to our shaper.





Welding is now vying with casting as a method of jig and fixture manufacture. Here are additional examples of welded jigs. Others appeared on page 395 of this volume

■



Jigs of Arc-Welded Steel

H. F. KNEEN
Factory Manager, Lincoln Electric Company

CHIEF REQUISITES in jig manufacture are accuracy and rigidity. Arc-welding of steel shapes supplies these requisites and in addition lowers weight and cost. Core-boxes, patterns, and time required for casting are eliminated. The jig at the left is used for drilling, reaming, tapping, and boring the frame of a hand-operated machine. It is 30 x 18 x 12 in., arc-welded from ¾-in. steel plate and bar stock. The jig at the right is 28 x 18 x 18 in., of ½-in. plate and bar stock. It is used to drill, ream, and tap a gearbox. Feet for these jigs are made of hardened steel, drilled and tapped to permit their attachment to square bar stock legs welded in place. Dowelling prevents turning of the feet, and the socket-head capscrews by which they are attached can be tightened to prevent tampering, as well as keeping foot diameter at a minimum.

The jigs at the top left and center are used for drilling clutch brackets of different sizes. They are arc-welded from ⅜-in. plate. The smaller is 12 x 8 x 6 in.; the larger 15 x 10 x 8 in. The piece is held by capscrews working through a tapped steel bar arc-welded in place. The jig at the top right is used for drilling and reaming a rocking box. It is shown resting on a stand which holds it for drilling two holes at an angle. The jig is 18 x 8 x 8 in., of ⅜-in. plate. Bosses and guides are of bar stock. Pins at the lower end of the stand fit holes in the jig to hold it in position. All jigs pictured were manufactured by the Niagara Machine & Tool Works.

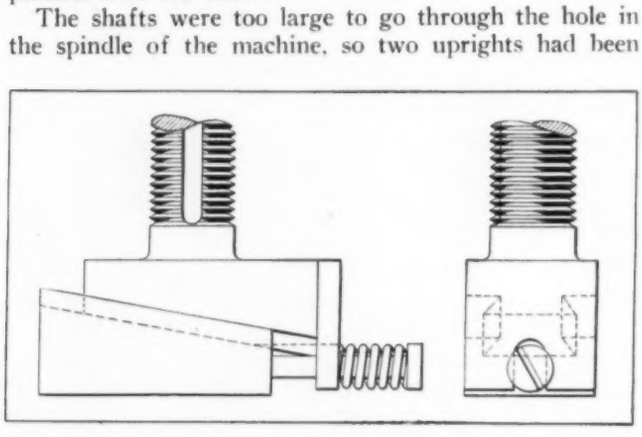
IDEAS FROM PRACTICAL MEN

Compensating Back Rest for Gear Cutters

MATTHEW HARRIS

WE WERE having trouble with the large gears used in printing presses. To be certain that the gears would be cut parallel and concentric with the shafts, the blanks were permanently keyed on the shafts before cutting the teeth. As the keys were tapered, driving them threw the blanks slightly out of true sidewise. This condition gave us no trouble, since the crankpin holes were drilled and reamed after the blanks had been keyed on the shafts, the jig holding the shafts vertically in V-blocks. Thus the holes were drilled and reamed parallel with the shafts.

The shafts were too large to go through the hole in the spindle of the machine, so two uprights had been



attached to the side. The uprights carried bearings that were arranged to slide up and down. They were moved up and down by screws, and had hinged caps for the easy admittance and removal of the shafts. Driving the gear blank for indexing was through a pin attached to a faceplate and passing through the crankpin hole in the blank. A certain amount of end float was allowed the shafts, so that the pressure of the cut would keep the blanks in contact with the back rest.

The trouble lay in the inability of the operator to adjust the bearings so that they would always be in alignment with the spindle. The adjustment had to be changed whenever the height of the spindle was changed for gears of different diameters, also for correct depth of cut each time the cutter was ground. It is easy to see that any misalignment between the spindle and the bearings would result in uneven spacing in indexing, because the blank has not revolved in exact unison with the spindle.

We had Brown & Sharpe build us a gear cutter with a special head in which the hole in the spindle was large enough to admit our largest shafts. Hardened and ground collects (front and rear) kept the shafts concentric with the spindle. When the machine was put in service, an unexpected trouble developed. As previously stated, the gear blanks ran slightly out of true sidewise. When the back rest was adjusted it could not bear evenly against both the high and the low spots on the blank. If it was adjusted to bear against the high spots, when the low spots came opposite to it, serious chattering occurred, resulting in a very rough cut. If the back rest was adjusted to bear against the low spots, when the high spots reached it the friction of turning was so great that the indexing mechanism did not function properly, the result being that some teeth were thicker than others.

To get over the difficulty, we made the compensating back rest shown in the illustration. The head of the back rest is planed at an angle of 10 deg., and a mating wedge is made to slide thereon, both members being dovetailed. The wedge is forced to move toward the high side of the incline by a spring. When the back rest is adjusted to bear against the gear blank, the wedge is in the position indicated in the illustration.

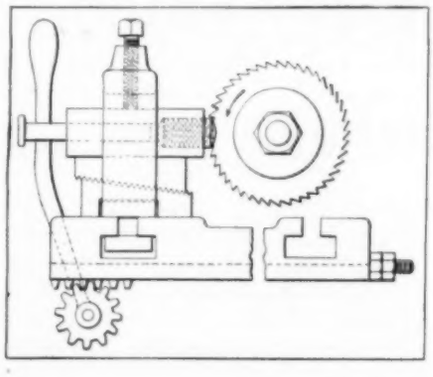
When indexing occurs, the friction between the gear blank and the wedge moves the wedge toward the low side of the incline, removing the pressure and permitting the blank to revolve freely in unison with the spindle. The spring keeps the wedge in contact with the gear blank at all times. At the first sign of chatter, the vibration of the gear blank permits the wedge to be forced by the spring toward the high side of the incline, and the greater the vibration from chatter the farther the wedge moves until it presses tightly against the gear blank, preventing further chatter. This back rest has been in use for several years and has never failed to function properly.

Fixture for Slotting Special Screws
Discussion

JOB S. DILLER

Having read the article by H. L. Wheeler, under the title given above, on page 789, Vol. 73, of the *American Machinist*, and the several discussions thereon, I thought it might be of interest to others to know the method we use for such work.

The work holder is simply a piece of square steel fitted with a plunger for an ejector and drilled at one end to hold the screws to be slotted. It is held in the high toolpost of our No. 2 Warner & Swasey turret lathe, as shown in the illustration. In order to have space for loading and ejecting the screws to be slotted, the holder



is shorter than the travel of the toolblock by the rack and pinion. For screws not long enough to be supported during the cut without danger of their being dragged out of the holder, the hole is made somewhat deeper than the length of the screws, and a slot is sawed in the holder, so that the saw can reach the screws. A stop screw at the rear of the toolblock controls the depth of the slots.

■

Gear Cutting in the Milling Machine

H. C. MEYERS
The Challenge Machinery Company

Occasionally the small shop has a chance at an order for cutting a large quantity of small gears, but hesitates to bid on it owing to a lack of gear-cutting facilities.

Some time ago, we accepted an order for 16,000 gears of 10 pitch, 20 teeth, and $\frac{3}{8}$-in. face. In the illustrations are shown the fixture that we built for the job. It was mounted on a milling machine of the Lincoln type. A cross-section of the center mandrel, which is connected to the four other mandrels by a train of gears, is shown in Fig. 1. Each mandrel holds 15 gear blanks. The index plate and the driving gear are keyed to the end of the center mandrel and are confined thereon by a nut.

By means of the indexing crank at the left, all five

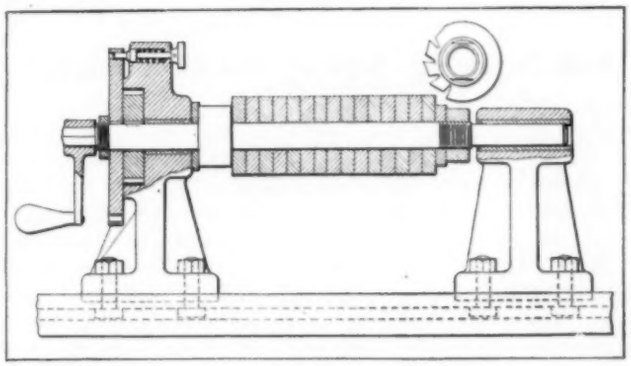


Fig. 1

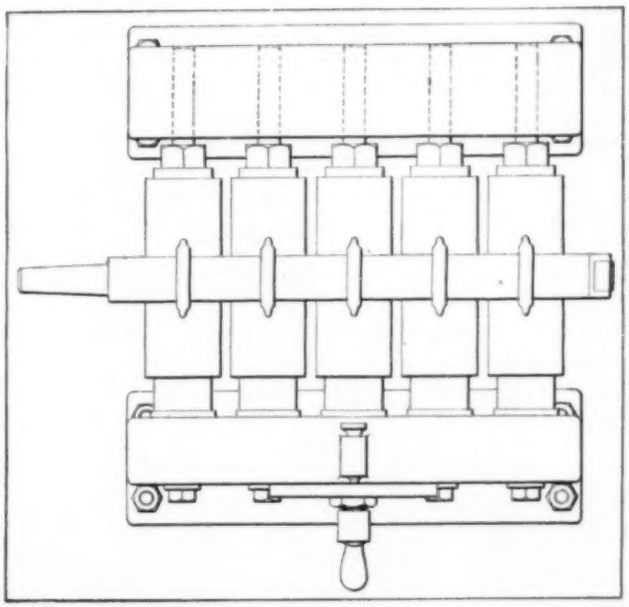


Fig. 2

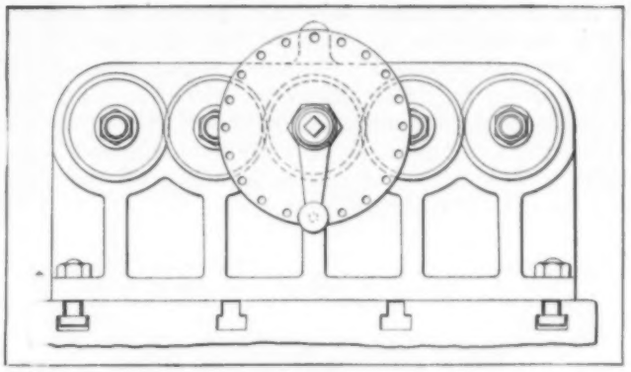


Fig. 3

gears and mandrels are revolved in unison, being indexed by the indexing pin shown. Plan and end views of the fixture are shown in Figs. 2 and 3, respectively. To load the mandrels, the tailstock is loosened and slid back, the gear blanks are placed on the mandrels, and the mandrel nuts are put on and tightened. The tailstock is then slid back into position and the nuts on the holding bolts are tightened. When tightening the mandrel nuts, it is necessary to block the index crank to prevent undue strain being put on the index pin.

Both the headstock and the tailstock are provided with bushings that serve as bearings for the mandrels. An end-thrust collar is provided for each mandrel at the headstock. In order to prevent spring of the cutter arbor, it was necessary to provide a center bearing (not shown). The fixture cost about $200, and, as far as this job was concerned it proved to be very efficient. The average production was 75 gears per hour, about the productive capacity of four gear cutting machines equipped with single mandrels.

■

Sharpening Tungsten-Carbide Tools

CHARLES O. LEWIS
Lucas Machine Tool Company

In sharpening tungsten-carbide tools in the usual way they must be ground on a special wheel. The operation must be carefully done and takes considerable time. Then, too, duplicate tools are required if the machine operator is not to lose time while his tools are being ground in the toolroom. With tools of high-speed steel, very little lost time is necessary as the steel is comparatively cheap and a good supply of sharp tools can always be kept on hand.

To overcome the objection of having the tools out of service for the time required to grind them, I use a Carborundum hand stone, No. 212, 8x2x1 in., 60 grit, to sharpen them without taking them out of the machine. I find that a minute or two is all that is required to restore the cutting edge on a tool. It is surprising how rapidly such a stone will cut, and there is no danger of checking the tool as when it is ground on a wheel.

I have in my department, Carboloy tools that have been in use for eighteen months and have never been ground. They have been kept in good condition by the use of a Carborundum stone such as has been mentioned above. A stone of the size mentioned is nice to hold in the hand and will last for a long time. If of 60 grit, it will not glaze over as will a finer stone. After the stone has

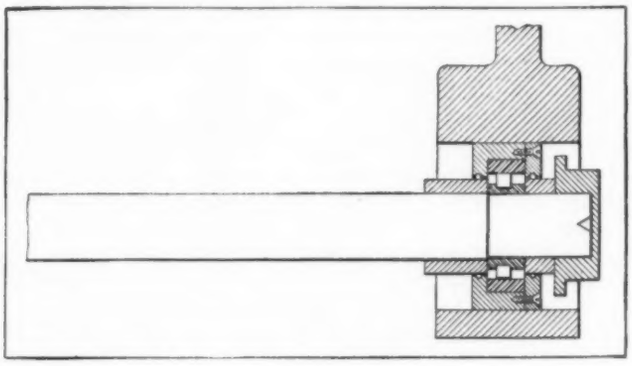
been used for some time, it becomes grooved and uneven, but it can easily be made flat by rubbing it on a hand lap. For this purpose I use a cast-iron plate about 12 in. square and 1 in. thick. The top surface has a number of V-shaped grooves crossing each other at right angles. The grooves are about $\frac{1}{16}$ in. deep and are spaced 1 in. apart. Loose Carborundum is sprinkled on the plate and the stone is rubbed upon it.

■

Anti-Friction Bearing for a Milling Machine Arbor

J. CONRAD WATSON
Master Mechanic, Franklin Pottery

Ball or roller bearings may have been applied to the outboard supports of milling machine arbors, but I have never seen any until we made the one here described. We do a great deal of radius and flat milling on high-carbon chrome steels, and the cutters always have a tendency to chatter. We tried a brass bushing in the outboard bearing, but if it was fitted too close on the



arbor, it got hot. If it was too loose, the cutter chattered and fine chips got in, scoring the bushing. We also tried a center in the end of the arbor, but it was subject to the same objections as was the brass bushing, excepting that the chips gave us no trouble. But when the arbor got warm from the cutter, it expanded and buckled, which changed the depth of the cut and endangered the success of the job.

We then ground the end of the arbor to a snug fit for a Norma-Hoffmann R-125 bearing. The brass bushing was removed from the outboard support and a container for the bearing was made to fit the hole, which was found to be about 0.002 in. taper. The container was made in two parts, as shown in the sketch, and was tapped snugly into the hole. Pieces of felt were placed in half-round grooves in the container so as to just bear on the arbor collars and keep out the chips and the dirt.

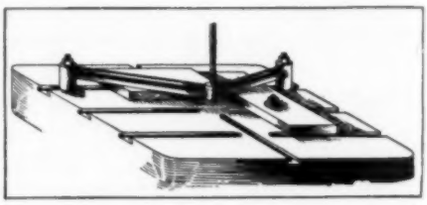
The inner ring of the bearing was clamped between the end collars of the arbor and revolved with it, while the outer ring was a press fit in the container. In setting up the cutter, the required number of collars and the bearing are placed on the arbor. The outboard support is then slid into place, the arbor nut is tightened, and the outboard support is clamped to the overarm. Thus no undue strain is put upon the bearing. The bearing could be used on any part of the arbor by grinding out the bore to fit the arbor.

Universal Jig Attachment for a Drill Press
Discussion

E. J. BRIGHT
Weybridge, England

While I was much interested in the universal jig attachment described by Glynn Williams on page 65, Vol. 74, of the *American Machinist*, I think the one here illustrated is much easier to make.

The jig is attached to the drill press table by bolts fitting in the T-slots, permitting it to be used on any drill press having a suitable table. The frame of the jig is cast iron and is ribbed for strength. The jig is so positioned on the table that the removable bushing is in alignment with the spindle. For locating the work, two plates or two parallels are so attached to the table that two of their edges form a right angle. Extreme accuracy of results is not claimed for this device, but it is quite suitable for some classes of work and, of course, it can be quickly set up on the machine.



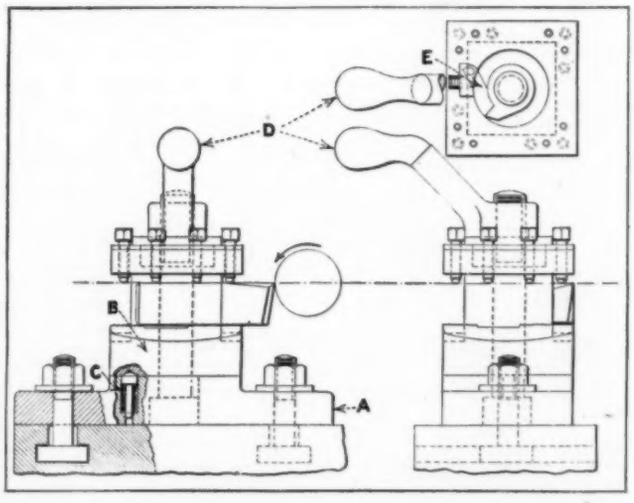
■

Self-Indexing, Square-Turret Toolpost

W. N. DELENK
Chief Instructor, The National Technical Institute

An engine lathe equipped with such a turret toolpost as is shown in the illustration, can perform several operations in quick succession at a great saving in time.

Referring to the illustration, *A* is the base to be attached to the carriage bridge, while *B* is the rotating part of the turret. The index pin *C* is backed by a spring and interlocks with any one of the eight dimples in the bottom of part *B*. By this means the turret can be indexed in increments of either 45 or 90 deg. The tool pockets are provided with the usual rocker wedges for adjusting the heights of the tool points. The operating lever *D* has the lower surface of the threaded part shaped in the form of a one-tooth ratchet. In the



plan view, the lever is shown in the position for locking the turret.

In indexing the turret, turning the lever 45 deg. to the left loosens the rotating part and brings the ratchet tooth into contact with the spring-actuated pawl *E*. Continued motion in the same direction, starts the turret to revolve, forcing the index pin downward and out of the particular dimple in which it is engaged. Because the lever must be turned to the right in locking the turret, the back of the ratchet tooth is beveled so that it will force the pawl into a pocket as it passes.

The base and the holding bolts must, of course, be made to suit the machine on which the turret is to be mounted. In our case it was attached to the rear of the cutting-off slide of a turret lathe, and was used as an additional square turret, as the machine was already equipped with a square turret on the front of the cross-slide. The tooling set-up was so complicated and the tools were so numerous that a second square turret was necessary. Such a turret can be made either round or hexagonal, the tools being held in holes, or in the case of the hexagon turret, they may also be held in holders attached to the turret faces.

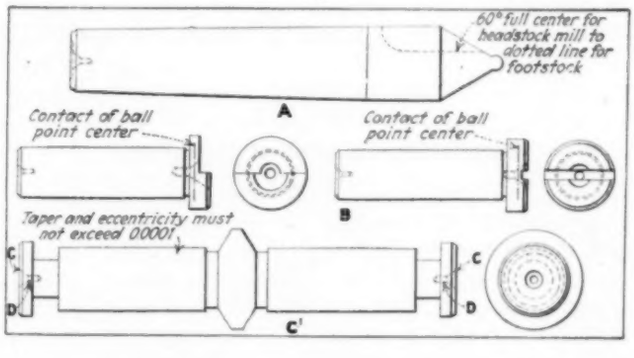
■

Ball-Pointed Centers for the Cylindrical Grinder

ALBERT L. EDDY
Foreman, Grinding Department
Heald Machine Company

We use ball-pointed centers, such as shown at *A*, when grinding parts similar to the ones indicated at *B*. To grind such parts truly cylindrical, using the ordinary pointed centers of 60 deg., would require a previous operation of burring, which can be omitted when using ball-pointed centers.

Center holes and their condition are the most important factors in precision grinding. Often the center



holes are not axially in line with the work, due to distortion of the work in hardening, or from misalignment when centering. In attempting to grind such work when held between pointed centers, the work will bear unevenly on the centers, as indicated at *C* and *D*, which will cause both the centers and the center holes to wear rapidly, making it difficult to keep the work either round or straight. To avoid this difficulty, it is necessary to perform the expensive operations of straightening the work and lapping the center holes in line.

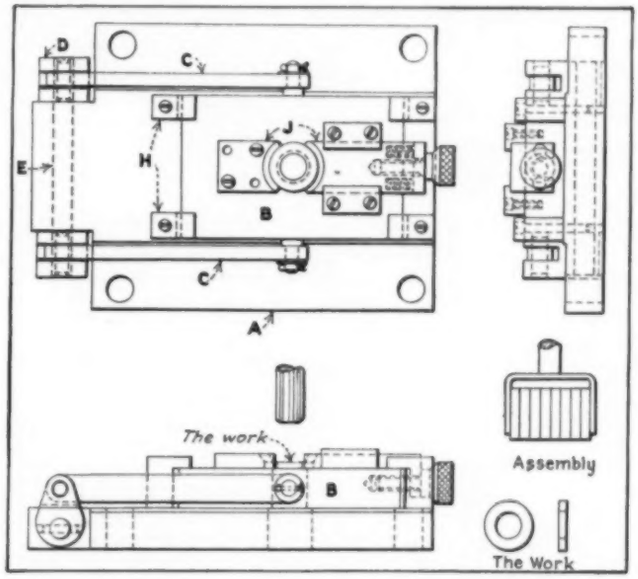
The real solution of the problem is to lap the center holes for roundness, using a 60-deg. lap that is split to hold abrasive cloth, and to use ball-pointed centers. Centers of this type will wear consistently at the points of contact, but the wear will be so uniform that there will be no difficulty in maintaining sizes and keeping the work free from taper.

■

Jig With a Floating Work Holder

H. R. SCHMIDT

In the illustration is shown a jig that was designed for reaming the holes in wheels for consecutive numbering machines. When the machine is assembled, the wheels are mounted on a shaft and are confined in a



housing. It is necessary that the holes be reamed square with the sides of the wheels, otherwise the wheels will bind and the machine will not function. The wheels were blanked and pierced in a punch press and then reamed without any previous boring. Originally, the wheels were chucked in a turret lathe, the reamer being held in the turret. While this method produced holes that were round, if the blanked holes ran out of true, causing the slender reamer to run out, the finished holes would be at an angle with the sides.

To overcome this difficulty, the jig illustrated was designed. By its use the work can be brought directly under the reamer, and should the reamer run out slightly, the work will follow the reamer, a condition that tends to produce holes that are slightly bell-mouthed on both sides, to which there is no objection.

Referring to the illustration, *A* is the cast-iron base, machined and scraped on the top to provide a smooth surface for the plate *B* to slide upon. At *C* are connecting rods in which the holes are larger than the corresponding pins on which they fit. The rods are attached at one end to the cranks *D*, the slots in which are wider than the thickness of the rods, so as to permit side motion. The cranks, in turn, are pinned to the shaft *E*. The other ends of the rods are attached to pins in the sides of the plate *B*. Clamps *H* hold the plate *B* down on the base, but permit it to move both sidewise and endwise,

its endwise movement being limited by the heels on the clamps.

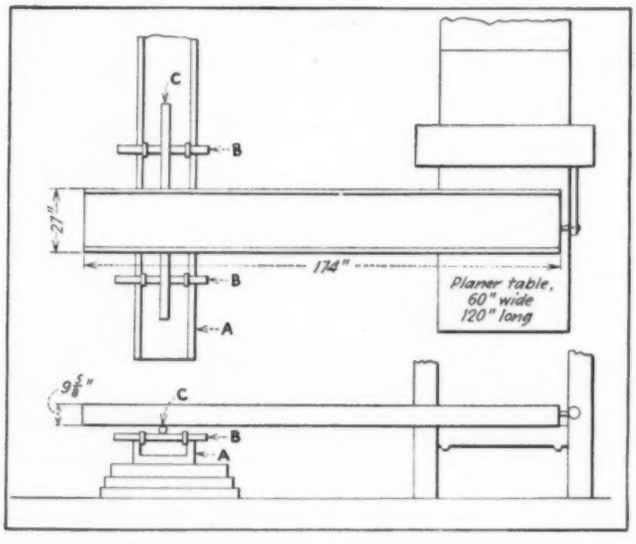
The steel jaws for holding the work are mounted on the plate *B* and are indicated at *J*. It is evident that in a jig of this design, the work can describe a small circle in following the run-out of the reamer, but it cannot revolve.

■

Handling Oversize Work on the Planer

W. B. LINCOLN, JR.
Chief Engineer, W. B. Savage Company

We had several castings, 174x27 in. to be planed on the tops and the ends, and since our largest planer was 60 in. x 10 ft. we had to resort to a rather unusual set-up. In planing the tops, the castings were mounted on the planer in the usual way, but because they were longer than the planer, they could not be planed the full length at one setting. They were planed nearly as far as the stroke of the planer would permit and were then shifted



far enough to permit planing the balance of their length. In shifting, the castings were carefully aligned with the part first planed.

Planing the ends presented more of a problem, but was taken care of as shown in the illustration. One of the castings that had been planed on the top was blocked up, as at *A*, to form guideways and was carefully aligned parallel with the planer table in both directions. Two rollers *B*, made of short lengths of 2 15/16-in. shafting, to which collars were attached to serve as guides, were placed on top of the casting. A third piece of shafting *C* was laid on the rollers and served to support the overhanging part of the casting. As the planer table moved back and forth, the shaft rolled on the rollers with practically no friction.

Since the casting could not pass through the planer housings, it was neceassry to use an extension bar 3½-in. in diameter and 36 in. long for holding the toolbit. The bar was mounted in a special cast-iron base piece rigidly attached to the side head of the planer. With the set-up described, the ends were planed in a reasonable time. There was no cost for equipment, excepting the base piece for holding the extension bar, as all the other items were put back in stock after the job had been completed.

SEEN AND HEARD

●

Cold Working of Steel

IN FORGING carbon-steel tools we were always told never to hammer below a red heat. But, according to Richard H. Kiddle, there are exceptions to all rules. 'Way back before the high-speed and T-C tools he had to drill a hole in an old vault. No carbon drill he had would touch it, so he forged a drill and kept hammering it until the steel was black, using lighter blows as it cooled off. This drill did not quite get through the vault, but it would put a hole through a file without much trouble. Cold working increased the hardness just as it does today in drawing or swaging cold metal.

Cold hammered drills were used by him in drilling chilled iron plowshares. He drilled from the back side, and as soon as the drill broke through, he stopped drilling and used a punch to break out the rest of the metal. Breaking out cupped the metal on the face side so that it made a good countersink for the flat head of the rivets.

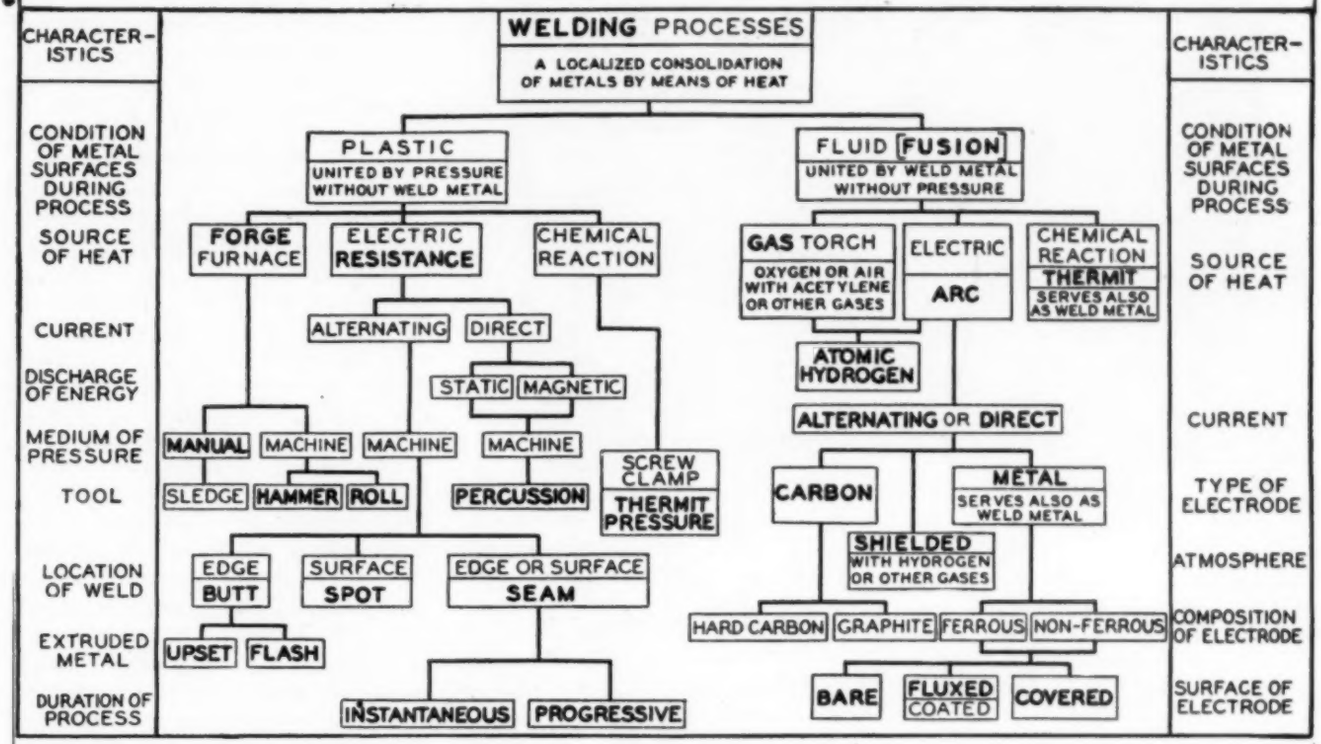
Changes in Ideas of Economy

IDEAS of securing economy change as the years go by. Years ago someone started the notion that it didn't pay to have a carpenter pick up nails he may have dropped. Then we began turning tons of metal from steel bars instead of using forgings because with the new lathes and the high-speed cutting tools it cost less to make scrap than to forge the work to size. Then we began to make better drop-hammer forgings, and the bar method took a back seat. Now we are using upset machines in many cases and reducing the amount of metal left for turning by half, or more, over the drop forging. Some day, perhaps, we will forge so closely to size that we can grind to size immediately, or even omit the grinder.

Burnishing Instead of Grinding

GRINDING has become such an established part of the manufacturing processes that we have come to look upon it as being fundamental where a finished surface is being considered. Railway shops have clung to rolling or burnishing as a finish for crankpins and axles, largely because some had no grinding machines and partly because some believed the rolling compressed the metal and made a better wearing surface. Some railways have abandoned rolling and are now grinding at a lower cost and with longer mileage for bearings. But things never stay put in machine-shop practice, and we find experiments under way with burnishing or rolling shaft surfaces that were formerly ground. One reason given is that the burnishing can be done by tools in one station of the turret instead of requiring a separate operation. On the other hand, it isn't as easy to hold sizes as was anticipated, although they can be maintained with sufficient accuracy for many places. —*J.R.G.*

Classification of Welding Processes



PRINCIPAL welding processes are classified in the above manner in an A.S.T.M. paper by F. T. Llewellyn of the United States Steel Corporation. The trade name of each process appears in bold type. In some, the characteristics overlap, and the classification should be considered to indicate predominant, rather than exclusive, features.

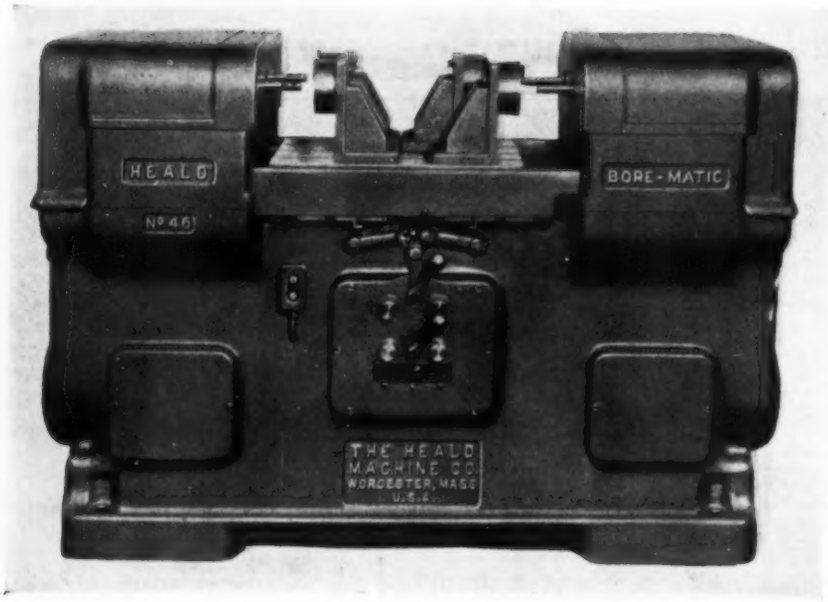
Welding may be briefly defined as a localized consolidation of metals by means of heat. While it is true that, as a laboratory experiment, the surfaces of certain metals can be united without heat, and that the several welding processes involve other factors in addition to heat, yet the importance of heat in all practical welding operations warrants its inclusion as a controlling factor in any useful definition. The definition includes subsidiary processes, such as brazing and soldering, in which unlike metals are employed, and whose product is not intended to transmit much stress; but such processes are not included in this classification.

The condition of the metal surfaces in the locality of the weld during the operation of welding is considered the first criterion in classifying welding processes. The metal's predominating condition may be either plastic or fluid. If plastic, the application of external pressure is necessary, but no added material is required, and parts are reduced in length, width, or thickness. If the surfaces are fluid, the addition of weld metal is necessary, but no pressure is required, and the joint is enlarged in length, breadth, or thickness. The term "fusion" is applied to those welding processes in which the surfaces are in fluid condition. The plastic condition of the metal surfaces during the other processes classifies them as "plastic." The plastic zone of most metals ranges from melting point down to about 100 deg. F. below melting. In a few metals, such as lead and cast iron, the zone is so narrow that they are difficult to weld except by fusion. In the case of many metals (copper, brass, bronze, aluminum) oxidation begins at the temperatures needed to prepare the work, and the welding operations must, therefore, either be instantaneous or shielded.

In the plastic processes, heat is produced either by a forge furnace, by resistance to electric current at the base metal surfaces, or by a progressive chemical reaction. In the fusion processes, heat is produced either by the combustion of gases mixed in a gas torch, by an electric arc, or by a chemical reaction similar to thermit. In many fusion processes, a temperature several thousand degrees Fahrenheit higher than the melting point of steel occurs at certain points in the heating medium.

© American Machinist

SHOP EQUIPMENT NEWS



Specifications

Maximum diameter of hole bored, in.	5
Minimum diameter of hole bored, in.	$\frac{7}{16}$
Maximum length of hole bored, in.	7
Distance, top of table to center line of std. boring spindles, in.	7
Minimum center distance between spindles, in.	5
Maximum center distance between boring spindles, in.	15
Boring head speeds, r.p.m.	1,200 to 5,000
Table feeds, in. per min.	$\frac{1}{2}$ to 15
Travel of table, in.	15
Rapid traverse, ft. per min.	15
Working surface of table, in.	16x26
Center to center distance of table ways, in.	$12\frac{3}{4}$
Floor space, sq.ft.	19
Net weight, lb.	7,000

"Bore-Matic" Horizontal Precision Boring Machine

FOR the employment of diamond and tungsten-carbide tools in the machining of the free-cutting materials, the Heald Machine Company, Worcester, Mass., is announcing its "Bore-Matic" horizontal precision boring machine. This machine will rough or finish bore straight, taper, blind, and interrupted holes in bronze, aluminum, fiber, Bakelite, and high-quality, soft cast iron. Hydraulic operation and massive construction permit tolerances of tens of thousandths of an inch for size, taper, and roundness on a production basis

The base of the "Bore-Matic" weighs approximately 3,700 lb. and has one V- and one flat way extending for the full length to support the sliding table. The lower portion of the base at the rear is extended to provide a solid mounting for the driving motor.

The table weighs approximately 850 lb., and its pressure lubrication is from the hydraulic system. The table itself is reciprocated by means of a hydraulic system similar to that on the Heald line of internal grinders. The table top is of tray design to confine the coolant and borings. A finished pad in the center, 16 in. wide by 26 in. long and having three longitudinal T-slots, provides for mounting and clamping the work fixtures. The boring head bridges are heavy one-piece castings, bolted to the base. Buttons on each bridge surface serve as locating points for lining up the boring heads, and three transverse T-slots provide for clamping them in position. A T-slot machined in the end of each bridge carries the idler pulleys of the boring head drive.

Besides having all of the controls concentrated on its exterior panel, the control box of the Bore-Matic contains within itself the valves to govern every function of the machine, except the starting and stopping of the driving motor. Referring to the close-up, Fig. 2, the starting and stopping of the table is controlled by the throttle lever (1). The boring feeds are controlled by two slow-down valves operated by levers (2), which are actuated by table cams (6). These cams can be made to give a constant feed for finishing a continuous bore or can be designed to give an intermittent feed with an intermediate period of fast travel for finishing interrupted bores. The valves are set by two conveniently located hand knobs (4), which can be adjusted so that a dierent rate of table feed is obtained at each boring position. Reversing lever (3) provides for both automatic and hand reversal of the table, the table moving in the direction in which the lever is thrown.

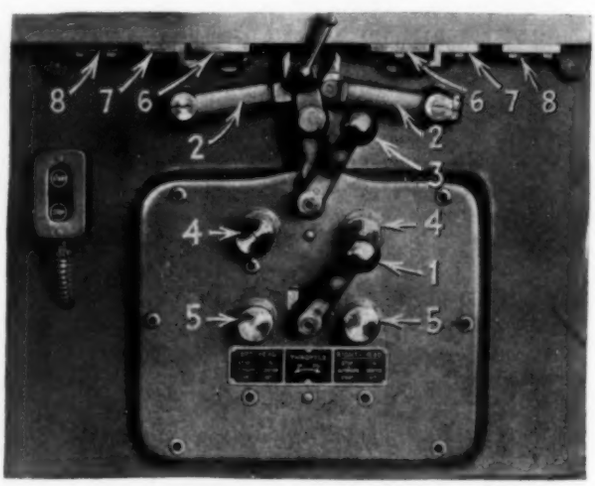


Fig. 2—Close-up of the duplicated controls of the Bore-Matic Precision Boring Machine

The start, stop, and automatic operations of the boring heads are controlled by two push-pull knobs (5), which move in and out of the control panel. These knobs are knee high so that the operator may quickly push them "in" to the stop position with his knee in case of emergency. Cams (8) on the table are the adjustable positive stops, which are used in connection with the reverse dogs (7) to obtain the safety reversing control. When both ends of the machine are being used for boring, the table traverses rapidly. In order to prevent this movement being made before the operator has finished loading the fixture, a safety reversing lever (9) is provided. The operator normally moves this lever each time he finishes loading one end of the machine, but if he is delayed the table will stop at the other end as soon as the boring is completed and wait until the safety lever is thrown.

Drive is obtained from one 7½-hp., balanced motor. From the jackshaft are driven the clutch-brake units which drive the boring heads, the oil pump of the hydraulic system, and the coolant pump. The left-hand clutch-brake unit is driven by a silent chain. Pin couplings and a connecting shaft, driving through herringbone reversing gears, transmit part of the drive to the right-hand unit. Thus, the clutch-brake units are driven in opposite directions, and therefore the multi-V belt and grooved pulley drive to each bank of boring heads causes each boring bar to have the same direction, or "hand," of rotation relative to the piece being bored. In other words, only one "hand" of tool is necessary.

Simple hand-operated mechanical fixtures can be used for the production of plain bushings, sleeves, guides and bearings. Automatic fixtures, operated either mechanically or hydraulically, can be built. The powerful drive for the heads permits the use of ball or plain bearing heads, as well as heads of special design. Either solid or quill-type boring bars or spindles are available.

Ruthman Grinder Pump

For incorporation in grinders and other equipment where excessive abrasive material is present in the coolant, the Ruthman Machinery Company, Cincinnati, Ohio, has developed the pump illustrated. The rotor shaft is supported by two heavy-

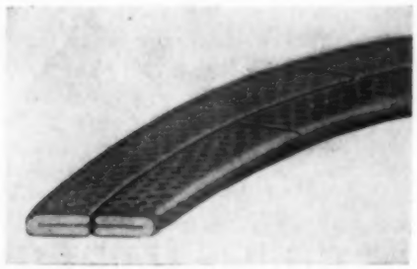
duty ball bearings and extends into the pump housing to carry the impeller. The impeller is designed to prevent clogging. An intake strainer has been provided integral with the base casting to eliminate injury to the impeller through the action of grit. The openings of this strainer are large enough to allow free passage of the liquid, but are sufficiently small to prevent large particles of waste or abrasive material from entering the intake. The pump requires no packing, felt washers, or close fits of any part coming in contact with the grinding compound. Ample room is allowed between the impeller and the housing to permit foreign matter to pass through freely.

The upper end bell, or motor bearing flange, of this pump is totally inclosed, thereby preventing dirt and drippings from getting into the motor. Wiring leads project through a conduit box mounted on the side of the motor frame for greater safety. The pump can be furnished both for immersed and outside installations and in sizes ranging from ¼ to 5 hp.

Garlock "Button Hole" Asbestos Tape

A new gasket material, under the name of "Button Hole Tape," is being manufactured by the Garlock Packing Company, Palmyra, N. Y. The material, constructed to replace asbestos tape on locomotive front ends and on flanged tanks of large diameter, is made up of two parallel courses of folded asbestos cloth, joined together by a single ply of bonding fabric. As shipped from the factory it contains no holes. Insertion of a knife blade between the sections cuts the bonding fabric, forming a button hole which slips readily over a bolt or stud. It is claimed that with no tools other than a knife the workman can make a perfect gasket which will remain in place, fit correctly, lie flat, and form a positive seal.

The tape is furnished printed with 1-in. graduation marks. For joining the two ends to complete the gasket, a step joint is recommended, and the finished joints can be wrapped with



Garlock "Button Hole" Tape used for gaskets on bolted flanges

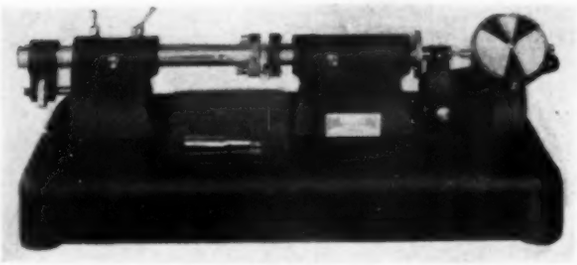
friction tape supplied. The material is manufactured in coils of any desired length, and in all regular widths and thicknesses.

"Federal" Screw-Thread Checking Gage

A screw-thread checking gage is being produced by the Federal Products Corporation, Providence, R. I. The general design was conceived by the engineers of the Carpenter Tap & Die Company, Pawtucket, R. I., and the unit is designed for checking

Applying Garlock "Button Hole" Tape to a drum flange

taps, screws, thread gages, and miscellaneous products. The dial indicator, graduated in 0.0001, is $3\frac{5}{8}$-in. in diameter. The dial is calibrated 0-5-0, and is equipped with a tolerance shutter which makes it extremely easy for operators to take readings in 0.0001 in. or closer if desired. The gage uses the 3-wire method of measuring, the individual wire being floating and the remaining two semi-floating. The gage can be changed instantly to allow for different sizes. It permits adjustable spring pressure against the part from $\frac{1}{2}$ to 6 lb., and work can be checked vertically or horizontally as desired. The tailstock has a vernier adjustment. The gage can be operated either by hand or foot, by the small lever. Over-all length is 24 in., and weight 200 lb.



Federal Screw-Thread Checking Gage

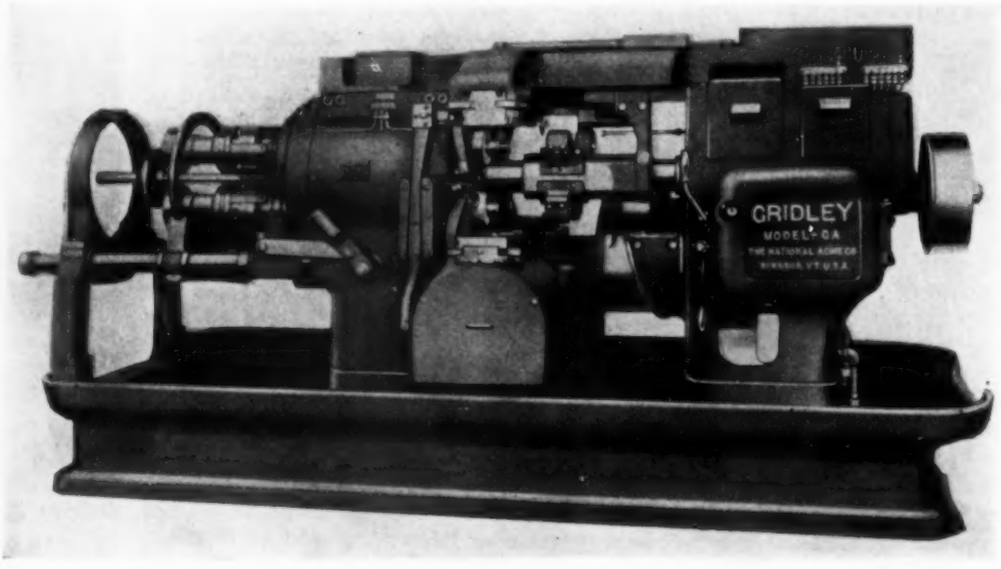
Gridley Model GA Multiple-Spindle Automatic Screw Machine

Massive construction in the Gridley Model GA automatic screw machine permits the unit to produce at a rate much higher than ordinarily achieved. The machine, placed on the market by The National Acme Company, 170 East 131st St., Cleveland, Ohio, employs a box-form frame with two independent uprights and a heavy top bracket to insure rigidity and elimination of vibration. The frame is so designed that the chips can drop through the center and into the pan. The front portion of the machine is entirely open, giving approximately four times the previous chip room and affording easy access to the tools for adjustment. Chip guards, mounted on rollers, can be moved sideways with little effort to permit tool adjustment. The oil is separated from the chips by means of a perforated plate in the pan.

The spindle carrier is supported on three bearings. This carrier is approximately 5 in. longer than on previous models, and the collet tubes and feed tubes are also longer in proportion. This construction makes for greater capacity and greater accuracy in alignment of the spindles. Both the spools and finger holders are of heavy design to provide for a larger bearing surface for the chucking shoe. The finger holders are provided with springs to prevent the fingers from flying out or loosening under the centrifugal force of high spindle speed. These springs are located inside of the finger holders so that no accident can occur when the machine is run without material in the collets. The feed tubes are guided inside of the finger holders and spindles. They are controlled by a ring and disk so that at no time can the feed tubes be out of mesh with the feed slide when the cylinder is indexed. The indexing mechanism is of the Geneva type, and is completely housed.

The main toolslide is of the usual Gridley design, but it has been lengthened approximately 5 in. and slides on a hardened and ground extension of the spindle carrier. The toolslide is bronze bushed at each end and provided with a wiper in front to prevent grit or chips from entering between the bronze bushing and steel extension of the carrier. In addition, the space between the spindles and the gearbox section has also been lengthened by approximately 5 in. to contribute greater strength to the main toolslide and to provide additional surface for mounting combination tools.

Both the forming and cut-off slides (the two bottom cross-slides) are mounted on supports cast integral with the bed. The upper two cross slides are exactly the same in design and construction. Each slide is



Gridley Improved Model GA Heavy-Duty Four-Spindle Automatic Screw Machine, which is made in four sizes—$1\frac{1}{4}$, $1\frac{5}{8}$, $2\frac{1}{8}$, and $3\frac{5}{16}$ in. The last machine actually has capacity for $3\frac{1}{2}$ in. bar stock. Both the spindle carrier and the main toolslide have been lengthened to provide greater accuracy and more space for combination tools

operated independently by cams. The two lower slides are operated by an adjustable roller direct from the cam drum. A drum is placed on each side of the machine for operating the four cross-slides, and is completely covered. This inclosure provides additional stability to the support for the forming and cut-off slides.

The chucking and feeding slide is supported by two heavy parallel shafts with extra long bearings to prevent side play or tipping. In addition, the chucking slide is supported at its extreme end with a guide shoe. The chucking shoes are provided with independent oil feed.

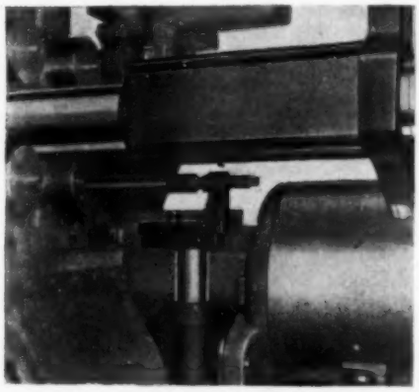


Fig. 2—Disappearing-type stock stop at the fourth position, which gives sufficient clearance for standard tools

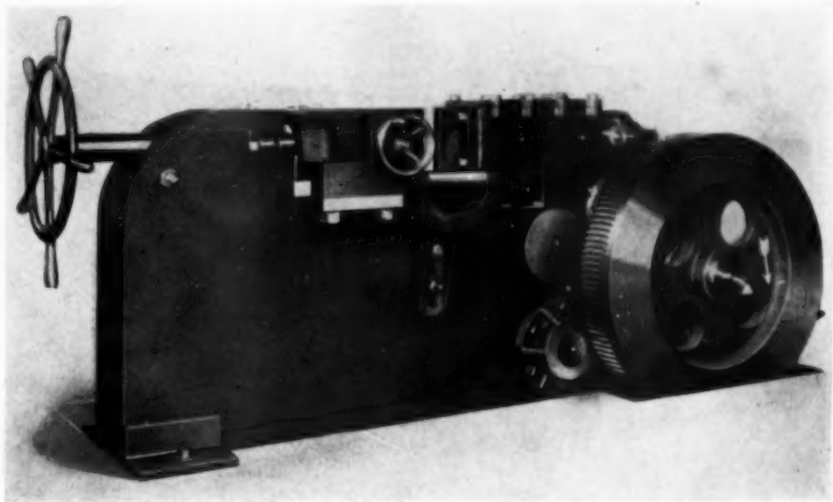
The main camshaft is controlled by a worm and worm gear, which also control the indexing mechanism, cross-slides, toolslide, and feeding and chucking mechanisms. The worm gear is equipped with a safety disk, which permits the worm rim to rotate and the camshaft to stop in case of dull tools or interference with any part of the machine.

To prevent noise, the spindle gears in the gearbox are of the helical type. These gears are of hardened steel, with the teeth burnished. The top bracket is provided with three independent oil chambers. The center portion of the top bracket contains the cutting oil reservoir, and several outlets at both ends simplify the oil connection for each tool. A double pump is provided for each machine, one for cutting oil for the tools and one for high-pressure oil for drills, reamers, and taps.

The stock stop, shown in Fig. 2, is of the disappearing type, with a straight up and down movement. This gives sufficient clearance in the fourth position to permit the use of standard tools, the same as in the other three positions. The reel is fastened securely to the end of the frame and pan. Independent stops are provided for each of the four cross-slides, as well as for the main toolslide. The machine can thread in either the third or fourth positions, or both, and these attachments can also be used for accelerated reaming or turning operations. High speed drilling attachments can be used in all four positions.

Buffalo "Armor Plate" Straightening Machine

A recent development in "Armor Plate" straightening equipment has been announced by the Buffalo Forge Company, Buffalo, N. Y. The machines are designed for the straightening of axles, rails, beams, channels, tees, and similar sections, and are designed along the lines of horizontal punches. The lower pressure blocks are adjusted by means of a handwheel and move in unison, thus assuring equal spacing at all times. The carriage is graduated and capacity tables are furnished with every machine, indicating what sections may be bent on any given centers. The carriage is adjusted by means of a large handwheel and heavy screw, and the adjustment is sufficient to allow up to the maximum section between the pressure blocks. Operation of the machine is continuous, there being no gags or clutches.



Buffalo "Armor Plate" Straightening Machine, which is built in three sizes

The plunger slides between the frames and is gibbed on both sides with bronze liners. The three pressure blocks are of hardened alloy steel and their standard shape may be changed to suit special conditions. The machine is provided with rollers to facilitate the handling of the work. It derives its name "Armor Plate" from its electrically welded, high-carbon-steel frame. These sections are guaranteed permanently against breakage. The table is a heavy steel plate welded between the frames. The gear is a steel casting and the pinion a nickel-steel forging, cut teeth being used throughout. The bearings are bronze lined. Alemite lubrication is provided throughout, except the flywheel bearing, which is of the ring-oiling type. Shafts are alloy-steel forgings.

The machine is available in three sizes: Nos. 47, 48, and 50, having distances between blocks of 6 to 14, 8 to 16, and 8 to 18 in., and ram pressures of 80, 130, and 190 tons. The smallest machine makes 40 strokes per min., and the other two each make 35, the strokes being 1, 1⅛ and 1¼ in. Capacity of the smallest machine (No. 47) is 6 in., 17.25-lb beams, that of the next size is 9 in. 30-lb. beams, and that of the largest size, 10 in. 35-lb. beams. Weights are 6,850, 11,000 and 16,500 lb.

Hanchett No. 900 Series Hydraulic Face Grinders

The No. 900 series hydraulic face grinders are being placed on the market by The Hanchett Manufacturing Company, Big Rapids, Mich. The illustration refers to the No. 984. The work table or platen is operated hydraulically by the cylinder and pistons. Table speeds range from 0 to 90 ft. per min., as standard. On special order this range may be increased to 160 ft. per min. The control is compactly designed and located behind the table and at left of the wheelhead. The various levers are conveniently placed for starting, stopping, reversing and changing the speed. A Tuthill constant-flow, gear-type oil pump is supplied and is mounted on a separate plate, so that the entire unit can be removed from within the machine bed. A 7½-hp. motor drives the pump.

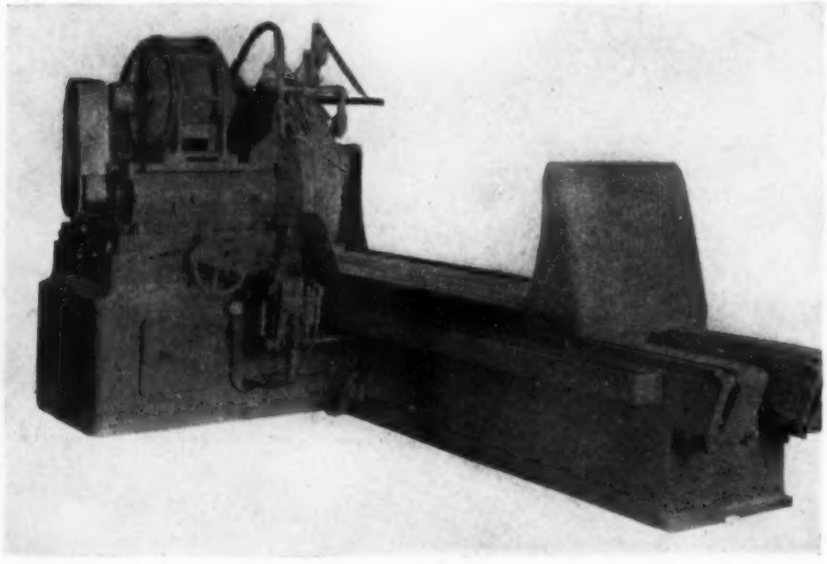
A pedal is placed within reach of the operator for bypassing the dogs and running the carriage to the safety dogs when loading, unloading, or inspecting the work. The grinding wheelhead is also connected hydraulically so that the forward travel of the wheel toward the work can be set to a pre-determined stop and provide automatic feeds ranging from 0.00025 0.005 in. Independent hand cross-feed is also supplied.

To prevent extensive wear of the ways from abrasive dust, heavy fabric composition belts are connected to each end of the table or platen, passing over adjustable pulleys and underneath the table through the bed. Forced-feed lubrication is also provided. The lubricant drains down into channels alongside the ways and through a Purolator system where it is cleaned, and thence returned to the oil pump for recirculation.

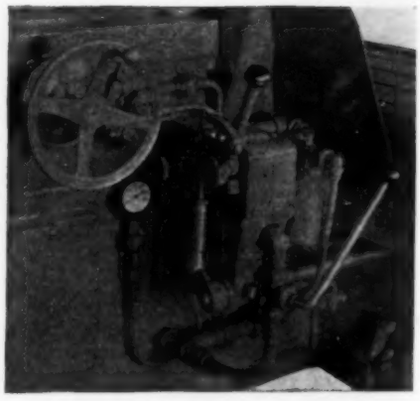
The No. 984 face grinder regularly carries a 36-in. segmental wheel chuck and is driven through a silent chain by a 40-hp. motor. A counterbalanced wheel dresser is a feature. The wheel spindle is provided with a brake for stopping it rapidly after the power is shut off. Precision-type radial and thrust ball bearings carry the large spindle. A motor-driven Ruthman coolant pump is located within the 75-gal. tank and discharges through two 1¼-in. outlets, one to the grinding wheel and the other to the work.

The width of the ways and the distance between them is much greater than common. The supporting bed for the table is of such length that the table never overhangs at either end of the stroke. Obviously, the machine can be used for knife grinding purposes as well as for railroad shop operations and general industrial use. It can be fitted with various types of plain and revolving magnetic chucks for knife bars.

The No. 900 series machines are made in various lengths, the capacities ranging from 50 to 192 in. Approximate weight of the 84-in. machine shown (the No. 984), including motors, chuck, wheels, and wet grinding system, is 18,500 lb. Floor space for this machine is 18 ft. x 7½ ft.



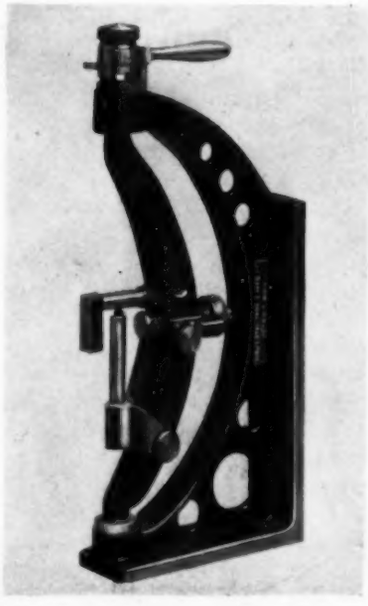
Rear view of Hanchett No. 984 Face Grinder (of the No. 900 Series), showing the belt-covered ways and powerful wheelhead



Close-up of grouped controls on Hanchett Face Grinders

"Majestic" Radius Dresser

A radius dresser, designed to fill the need for a compact, accurate, and efficient tool with which to dress rapidly either concave or convex forms on grinding wheels, is being manufactured by the Majestic Tool & Manufacturing Company, Detroit,



Mich. It is constructed to permit its adaptation to a large majority of grinding machines without expensive accessory jigs and fixtures.

Construction throughout is of specially normalized and heat-treated steel. The rotor arm is supported on each end with tapered, hardened, and ground bushings which are adjustable, allowing any looseness that may develop during use to be eliminated by loosening of a setscrew and turning of a thumb nut. The lower bushing, being in line with the flow of dust and grit from the dressing operation, is protected by a metal shield.

To permit accurate dressing of radii on wheel corners, such as on crankshaft grinders, the dresser is equipped with a graduated dial with adjustable stops to allow dressing of 90 deg. without fear of the diamond digging into and marring the wheel face. The stops are adjustable to any segment of a circle, the graduations being in 5-deg. steps to permit quick setting.

A feature of the toggle-action diamond holder lies in the fact that it is possible to dress concave radii to a full 180 deg., without excessive grinding away of the diamond mounting. The toggle is easily removed to permit insertion of a radius diamond for the dressing of convex radii.

Each dresser comes equipped with an anvil-type gage, a ½-in. bushing, a toggle-action diamond holder with micrometer screw control, permitting ½-in. travel, graduated in thousandths of an inch, and two "Staset" radius dressing diamonds. The anvil-type gage with a ½-in. bushing, both of hardened and ground tool steel, makes the diamond set-up for either concave or convex radii possible. The dresser may be used without the necessity of removing the wheel guard.

Henry & Wright All-Steel Straight-Sided and Inclinable Presses

A series of all-steel, straight-sided and inclinable presses has been added as a complementary line to the dieing machine made by The Henry & Wright Manufacturing Company, Hartford, Conn. The straight-sided presses are furnished in either flywheel, singe-geared, double-geared, or triple-geared types with crankshafts up to 12 in. in diameter, the larger presses being equipped with single or twin-geared drive, as preferred. Fig. 1 shows the shrunk-in tie-rod construction employed in the straight-sided, single-crank press. The base, uprights, crown and slide are made from steel plates cut and formed to shape and arc welded. These fabricated steel units are annealed before machining to eliminate strains and thus remove any tendency to distort after the machines are put in operation.

The construction used in the base gives support to the dies under the severe eccentric loadings. The uprights are hollow rectangular sections internally reinforced, and having long guides on the outside for the slide. The heat-treated crankshaft is made from a hammered, alloy-steel forging and is mounted on bronze-bushed bearings in the crown. Both the upper and lower ends of the connection are made from electric furnace steel castings, the upper end being bushed with hard bronze and the lower end, or wrist, contacting a hard bronze lining mounted in the slide. The guides on the uprights are made of such length as to give the proper alignment to the slide at all times, the rear guide being bronze lined, while the angular gib is made of close-grained grey iron. All gears on the geared presses are of welded steel construction, the rims being made from 0.40 carbon steel, while the web and hubs are made from 0.10 carbon steel, and annealed before machining. Pinion shafts are mounted on Timken roller bearings.

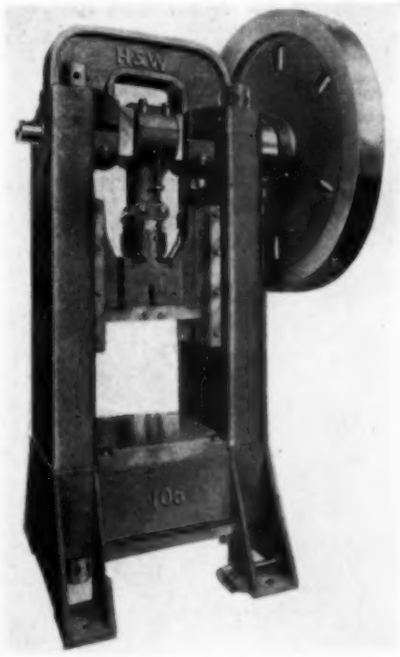


Fig. 1 — Henry & Wright All-Steel Straight-Sided Press of the single-crank, flywheel-type

On the inclinable presses the frame, slide and legs are of welded-steel construction, annealed before machining. Heat-treated crankshafts and bronze-bushed bearings are also employed as above. The lower end of the connection is of the ball type and contacts with a hard bronze seat in the slide. Welded steel gears are also used in the geared types of inclinable presses, and the backshafts are mounted in Timken bearings. The design of the throat on the inclinable presses gives additional die space, but also distributes the stresses proportionately throughout the frame.

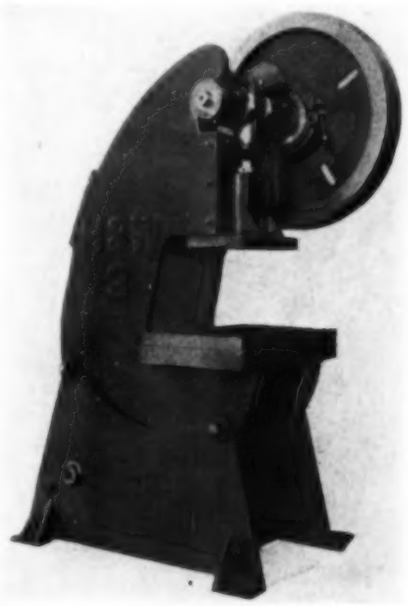


Fig. 2 — Henry & Wright All-Steel Inclinable Press, which has the throat designed to give large die space

Any change or modification in these presses can be made to suit the customer's particular needs. This is made possible by the absence of pattern requirements and consequent foundry delays, since the plate can be laid out and fabricated quickly.

Toledo Cold Forging and Stamping Press

A cold forging and stamping press weighing approximately 85,000 lb. has been developed by The Toledo Machine & Tool Company, Toledo, Ohio. This press is particularly adapted for extruding valve heads, coining the covers on globe valves, and also any kind of forging, forming, or stamping within its capacity.

The frame is of steel tie-rod construction with forged steel tie-rods. The crankshaft is of the semi-eccentric type, heat-treated, and exerts a pressure of 500 tons at the bottom of the stroke. Bearings at both the frame and the connection are bronze bushed. The slide measures 24x26½ in., the bed 32x33 in., and the stroke is 12 in. The distance from the top of the bolster to the underface of the slide, stroke down and adjustment up, is 28 in. Any of these dimensions, however, can be changed readily to suit special conditions.

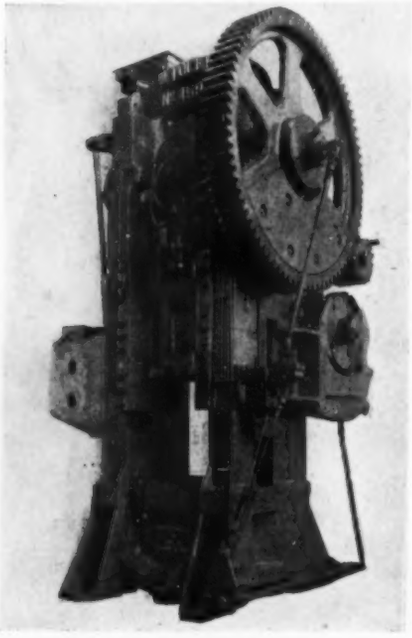


Fig. 1—Toledo Cold Forging and Stamping Press, which weighs 85,000 lb. and exerts a pressure of 500 tons

Other important features are the arrangement of the double gearing, the clutch, and the clutch control mechanism. Referring to the rear view, Fig. 2, it will be seen that the press is double geared, with an extra pinion on the drive shaft and an extra gear on the intermediate shaft to give two gear ratios, one of 8:1 and the other 20:1, in order to operate the press at either 12 or 30 strokes per min. The change in the gear ratio is made very similar to that on an automobile. The clutch is of the improved multiple-disk friction type, mounted in the flywheel of the press on Timken roller bearings. At the extreme other end of the shaft is the brake. Separating the flywheel and the brake eliminates heating up the clutch from braking. The clutch control mechanism is so arranged that the press may be operated either by a foot or hand lever. A simple adjustment permits the press to run continuously or be stopped automatically at the top center or instantly at any point of the stroke. The last feature is particularly desirable when setting dies. A cam-actuated lower liftout is furnished for raising the work from the die.

Fig. 2—Rear view of Toledo Cold Forging and Stamping Press, showing that the machine is of double-geared construction

Timken roller bearings are employed in the drive shaft. Power is supplied by a 30-hp. motor, the pulley of which is connected to the flywheel of the press by means of a belt drive. Centralized forced-feed lubrication is employed so as to lubricate all of the main bearings from the floor.

"Loadmaster" Revolving Boom Crane

The Bucyrus-Erie Company, South Milwaukee, Wis., has taken over the manufacture and sale of the Loadmaster revolving boom crane, formerly sold by Frederic H. Poor, Inc., New York City. This mobile crane, with a boom swing of 360 deg., has a rated capacity of 3,500 lb., although heavier loads can be handled under special conditions. The maximum working reach is 14-16 ft. The ma-

"Loadmaster" Revolving Boom Crane which has a rated capacity of 3,500 lb. and a reach of 16 ft.

chine may be mounted either on crawlers or on rubber-tired wheels, in the latter case having the maximum traveling speed of 11 miles an hour.

Dumore Midget High-Speed Precision Grinder

The "Midget" high-speed precision grinder, announced by the Dumore Company, Racine, Wis., can be used in a bench lathe, milling machine, or grinder, and also as a hand tool. As a tool for offhand grinding, it is particularly adapted to the finishing of small openings, radii, and irregular shapes in dies. Correcting inaccuracies in blanking dies, providing top rake of a form tool, sharpening dinking dies and button dies are a few of its uses. In addition, the tool post shank provides a solid mounting for lathes, milling machines, or other machine-tool set-ups for internal and external grinding operations and high-speed drilling operations. Drills from No. 42 to No. 22 inclusive can

be used. A special wood handle, which slips over the tool post shank, is provided.

The 1/20-hp. motor used on the Midget has the armature dynamically balanced to insure freedom from vibration. Ball bearings with automatic take-up are employed. An aluminum housing keeps the weight down to 1¾ lb. Chuck collets permit the use of round shanks ranging from 3/32 to 5/32 in. The collet is attached directly to the armature shaft.

Maximum speed of operation is 20,000 r.p.m.; full-load speed, 10,000 r.p.m. The motor switch is located conveniently in the motor case.

Barnes No. 12 Automatic Lathe with Multi-Range Feeds

An automatic hydraulic lathe of less capacity than the No. 17 has been placed on the market by the John S. Barnes Corporation, Rockford, Ill. This lathe, designated as the No. 12, has a swing of 13 in., and incorporates multi-range hydraulic feeds. By casting the base, bed, and headstock integrally, the machine is caused to have exceptional rigidity. As a consequence, vibration is eliminated and the alignment is maintained.

The multi-range hydraulic feed is non-pulsating, and is furnished by Barnes pumps driven and controlled from the main spindle. A separate gear pump supplies the rapid traverse. A single lever controls the rapid traverse, and the speed and feed mechanisms are operated in response to the rapid traverse action.

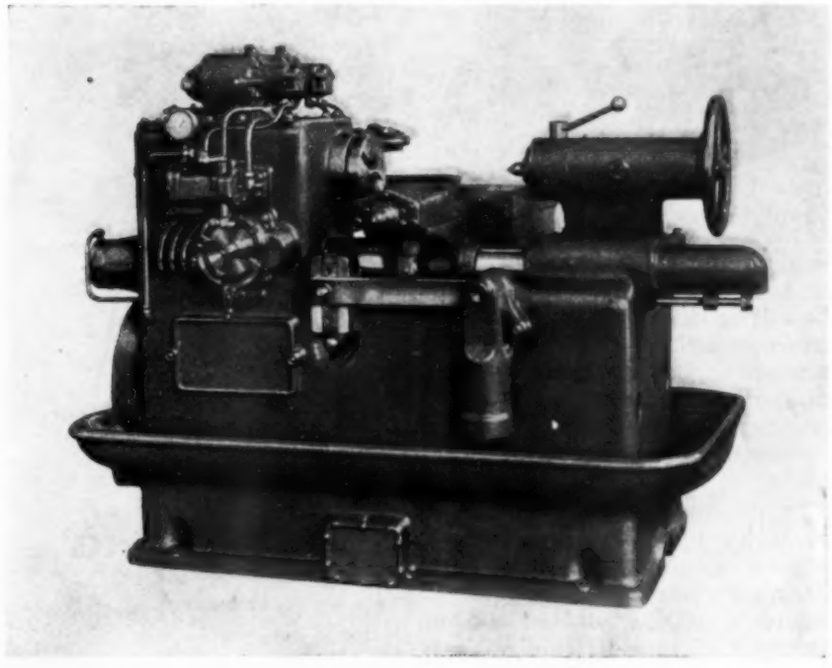
The range of feeds is from 0.001 to 0.100 in. per revolution of the main spindle. The feeds of the front and rear carriages are entirely independent, and a dial for setting each is provided. These dials are graduated to show the feeds in thousandths.

High spindle speeds for turning steel as well as other metals with tungsten carbide tools is another feature of this machine. Speed changes are made by means of pick-off gears, while herringbone gears drive the spindle, thus making only two gear contacts in the machine. The spindle is mounted in anti-friction bearings and rotates clockwise, the same as in the No. 17 lathe. This construction transmits the cutting pressure directly to the lathe bed.

The front carriage is clamped upon and supported by a 4-in. horizontal bar, which is mounted on bearings in the lathe bed. It carries an adjustable cross slide for holding tool blocks. Longitudinal feed to the carriage and the bar is obtained directly from the piston rod in the horizontal cylinder at the headstock end. Cross feed is obtained in like manner, the piston rod in a vertical cylinder on the front of the lathe being attached to a guide bar, the other end of which is pivotally mounted on the lathe bed. A roller under the carriage runs on the guide bar. Accurate feeding to depth

SPECIFICATIONS

Swing, in.	13
Distance between centers, in.	18
Range of spindle speeds, r.p.m.	114-622
Diameter hole in spindle, in.	1¼
Travel of front carriage, in.	7
Travel of rear carriage, in.	5
Floor space, in.	47 x 77
Weight, lb.	5250

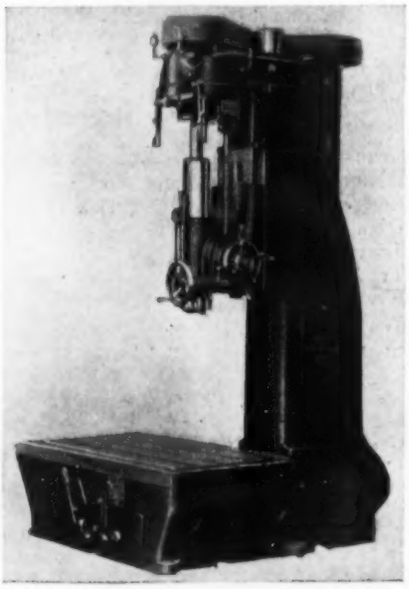


is assured as the guide bar is fed upward against an adjustable stop. With this arrangement the turning of tapers can also be undertaken. Adjusting the pivot for the guide bar up or down gives the taper desired.

The rear tool carriage is bolted to a large flat surface on the rear of the lathe and can be moved longitudinally along the bed to whatever position is desired. The tailstock is also bolted to the large flat surface of the lathe bed and has a ball bearing center.

Reed-Prentice No. 5 Special Jig Boring Machine

A special No. 5 jig boring machine especially adapted for boring the top and bottom sections of cast-iron subpresses for electrical-lamination blanking and piercing operations has been built by the Reed-Prentice Corporation, Worcester, Mass. For this



particular work, extreme accuracy is required for boring the four pilot-pin holes in order that the life of the die will be increased. By the use of hardened steel pins operating in cast-iron holes, allowing a driving fit at the start, it has been found that this construction gives longer life to the die because of the accuracy maintained.

Specifications on the No. 5 special jig boring machine are as follows: eighteen spindle speeds from 25 to 900 r.p.m.; power feed to spindle, 15 in.; feeds, 0.005, 0.010, and 0.020 in. per revolution; spindle travel accuracy guaranteed within limits of plus or minus 0.00025 in. in 15 in.; spindle taper, No. 5 Morse; throat depth, 20 in.; maximum distance from the spindle to the table, 39 in.; and solid box table measuring 36 x 70 in. offset as shown.

Grant No. 2A Rotary Vibrating Riveter

The No. 2A riveting hammer illustrated has been added to the line of riveting machines manufactured by the Grant Manufacturing & Machine Company, Bridgeport, Conn. This riveting machine is designed to head rivets cold from 3/32 to 3/16 in. in diameter. It is known as a vibratory riveter, the hammer spindle being caused to vibrate in the vertical direction between 1,500 and 2,400 blows per min., as required by the rivet size. The frame is a single casting, designed to withstand the heavy vibration of the riveting operation.

The standard table has a flat top to permit fixtures to be attached, but a specially constructed table can be furnished to suit the work. The riveting tool, or peen, used on the machine is threaded to fit the outside diameter of the hammer spindle. It is made from hexagon stock, as this permits the use of a wrench.

The hammer spindle is rotated clockwise by a worm drive located inside of the spindle arm. The worm shaft is driven by a V-belt directly

connected with the main shaft at the rear of the machine. An eccentric bearing on the main shaft gives the connecting rod a reciprocating motion. This connecting rod passes through the thrust block at the rear end of the helve, thereby transmitting the reciprocating motion to rubber cushions, which, in turn, act on the thrust block, causing the helve to vibrate in the hammer spindle.

The main pulley has been made part of the clutch mechanism and means for lubricating it are provided. The clutch is of the friction disk type with a Raybestos lining. A brake is also provided to stop the hammer spindle in its uppermost position so as to allow work to be inserted and removed easily.

PATENTS

APRIL 21, 1931

Metal-Working Machinery

Automatic Indexing Mechanism. Fred Hunziker, Cleveland, Ohio, assigned one-half to The W. J. Schoenberger Co. Patent 1,801,601.

Riveting Apparatus. Percy F. Woods, Butler, Pa. Patent 1,801,651.

Machine-Tool Organization. Fred A. Parsons and Joseph B. Armitage, Milwaukee, and Edward J. Kearney, Wauwatosa, Wis., assigned to Kearney & Trecker Corporation. Patent 1,801,686.

Drilling Machine. Willy Schubbe, Gera, Germany. Patent 1,801,881.

Inverted Hydraulic Ram Press. Abram C. Wisner, Jackson, Mich., assigned to Reynolds Spring Co. Patent 1,801,893.

Gear Generating Machine. Edward W. Miller, Springfield, Vt., assigned to the Fellows Gear Shaper Co. Patent 1,802,181.

Tools and Attachments

Apparatus for Making Fastener Sliders. George W. Blair, Mishawaka, Ind., assigned to Mishawaka Rubber & Woolen Manufacturing Co. Patent 1,801,325.

Means for Setting Dies in Presses. Theodore G. Falstrom, West Orange, N. J., assigned to Monroe Calculating Machine Co. Patent 1,801,490.

Indexing Chuck. Fred Hunziker, Cleveland, Ohio, assigned one-half to The W. J. Schoenberger Co. Patent 1,801,602.

Supporting Attachment for Lathes. William W. Bulifant, Miami, Fla. Patent 1,801,719.

Reamer Attachment for Die Stocks. Russell E. Elliott, Brackenridge, Pa. Patent 1,801,730.

Adjustable Boring Bar. John H.

Smith, Detroit, Mich., assigned to Wesson Sales Co. Patent 1,801,883.

Apparatus for Balancing Annular Parts. Robert C. Wells and William F. Koelpin, Milwaukee, Wis., assigned to International Harvester Co. Patent 1,801,989.

Broaching Equipment. Carl J. Halborg, Detroit, Mich., assigned to Colonial Tool Co. Patent 1,802,053.

Soldering Apparatus. Carl Helle, Brunswick, Germany, assigned to Elektrische Lot-und Schweiss Gesellschaft mit beschrankter Haftung, Brunswick, Germany. Patent 1,802,079.

Non-Rotary Self-Opening Die Head. Ewald A. Barteit, New Haven, Conn., assigned to The Geometric Tool Co. Patent 1,802,103.

Furnaces

Metal Transfer and Heating Mechanism. Walter H. Holt, Pittsburgh, Pa. Patent 1,801,349.

Furnace. Frank W. Brooke, Pittsburgh, Pa., assigned to William Swindell & Brothers. Patents 1,802,000 and 1,802,001.

Portable Furnace. Alexander N. MacDonald, Toronto, Canada. Patent 1,802,146.

Processes

Process for Graphitizing Castings of White Cast Iron. Anson Hayes, Middletown, Ohio, assigned to Industrial Furnace Corporation. Patent 1,801,742.

TRADE PUBLICATIONS

BALL-BEARING LOAD COMPUTATION MANUAL. The Marlin-Rockwell Corporation, successors to the Gurney Ball Bearing Co., Jamestown, N. Y., has issued a booklet "Strom Ball Bearing Load Computation Manual" for engineers and designers. It simplifies the methods of calculating the load imposed on a bearing by various types of gears and drives. It is written very compactly and so as to make for ready reference.

BLOWPIPES & BURNERS. The American Gas Furnace Co., Elizabeth, N. J., has issued bulletin No. 6 entitled "All About Gas Blowpipes, Tip Burners, and Fish Tail Burners, etc." The burners are for local hardening and tempering and also for soldering and brazing.

BORING MACHINE. The Keller Mechanical Engineering Corporation, 70 Washington St., Brooklyn, N. Y., has issued a profusely illustrated catalog on the operation and construction of the "Kellocater" jig boring machine, recently described in these pages.

COMMERCIAL LAPPING. The Norton Co., Worcester, Mass., has issued a booklet "Commercial Lapping for Close Limits and High Production," describing the machines and the fields for use of lapping.

GAGES. The Taft-Peirce Manufacturing Co., Woonsocket, R. I., has issued a pamphlet describing its Style 9042 adjustable flat plug gage; style 9033 adjustable snap gage, and style 9032 adjustable external limit gage.

HEAT-TREATING. The Vincent Steel Process Co., 2434 Bellevue Ave., Detroit, Mich., has issued a leaflet entitled "Scientific Heat-Treating" telling of the part played in scientific heat-treating by modern temperature controllers and furnaces.

HEATING & VENTILATING UNIT. The Reznor Manufacturing Co., Mercer, Pa., has issued a bulletin on the type V gas-fired warm-air, forced-circulation heater suitable for use in factories, illustrating thoroughly the design and construction.

MILLING AND SLOT MILLING MACHINES. The Superior Machine & Engineering Co., 1930 Ferry Park, Detroit, Mich., has issued two bulletins respectively on its single- and double-spindle milling machines and the slot miller. Botlr bulletins are completely illustrated and specifications are tabulated.

MONEL METAL & NICKEL. The International Nickel Co., Inc., 67 Wall St., New York, N. Y., has issued a bulletin entitled "Engineering Metals for the Process Industries," which contains considerable information published in *Chemical & Metallurgical Engineering* on the application of Monel metal and nickel to process equipment.

OIL CUPS. The Gits Bros. Manufacturing Co., 1846-62 So. Kilbourn Ave., Chicago, Ill., has issued catalog No. 31 on "Oil Cups, Automatic Multiple Oilers, and Oil Seals." This shows many new items and comprises 103 11x8½ in. pages, showing a wide diversity of equipment and listing the specifications and prices.

POSITIVE DRIVES. The Link-Belt Co., Indianapolis, Ind., has issued an illustrated book, No. 1293, describing its complete line of positive drives: Silent chain, roller chain, herringbone speed reducers, worm gear speed reducers, steel and malleable chains, and the P.I.V. variable-speed transmission. The booklet is entitled "A Saving at Every Turn" and is largely pictorial in treatment, showing typical installations of these various positive drives, together with brief descriptions of their scope.

PRELOADED BALL BEARINGS. SKF Industries, Inc., 40 E. 34th St., New York, N. Y., has issued bulletin No. 203 on preloaded ball bearings for precision spindles. After reviewing the methods for preloading ball bearings, an analysis is given of the deflection and stresses involved and the action of the bearing under axial load. Typical applications to machine tool spindles, such as lathes, grinders, and milling machines, are described with the aid of cross-sectional views.

RESEARCH SERVICE. The University of Michigan, Colleges of Engineering and Architecture, Department of Engineering Research, Ann Arbor, Mich., has issued a publication, "Research Service for Industry," illustrating the equipment available and discussing the types of fundamental research which can be undertaken.

REVERSING MOTOR PLANER DRIVES. The Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has published bulletin No. 1152 on "Reversing Motor Planer Drives," these drives being the ultra-speed drive equipment and the constant-voltage drive equipment. Applications of these drives are thoroughly illustrated and the advantages are listed.

SKF DATA SHEETS. SKF Industries, Inc., 40 E. 34th St., New York, N. Y., has revised its load ratings for all bearings in bulletin No. 205-B, which supersedes all other engineering data sheets. The new ratings are based on established principles of fatigue life and also take into account improvements which have been effected in design, material, and manufacture. Dimensional data and speed and load ratings for all types of ball bearings, straight cylindrical roller bearings, and spherical roller bearings are included, as well as tables of shaft fits and housing tolerances. The bulletin contains 72 8½x11-in. pages.

SHOP SAFETY. The National Safety Council, 20 No. Wacker Drive, Chicago, Ill., has issued a bulletin entitled "Shop Safety," containing 40 pages, 4⅝x6⅞ in., of specific information of value to workers on how to avoid accidents. Single copies are $0.10 to members, and at lower prices in quantity.

THREADING TOOLS. The Toledo Pipe Threading Machine Co., Toledo, Ohio, has issued Catalog L for 1931 on its pipe threading devices, cutters, machines, power drives, work benches, and sundries.

THE EX-CELL-O PLANT. The Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., has issued a book entitled "Ex-Cell-O, Its Plant, Personnel and Products," which is very extensively illustrated with pictures of the personnel, types of work undertaken, and the manufacturing facilities.

WORM-GEAR SPEED REDUCERS. The Foote Bros. Gear & Machine Co., Station "C," 215 No. Curtis St., Chicago, Ill., has issued catalog No. 301 on its "IXL HYGRADE Worm Gear Speed Reducers." The bulletin comprises 78 11x8½ in. pages, giving extensive information on the development and design of worm-gear speed reducers and listing the present sizes manufactured their specifications, and prices.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, April 30, 1931

VOL. 74 NO. 18

Four Steps

PROFESSOR YERKES of Yale has set out four steps to indicate how a scientist would go about drafting a new law: Get together the facts surrounding the problem; study the problem and relate the facts to it; choose a way by which human beings can best be tempted to regulate themselves, in view of the facts; make tests to see if the solution is sound, later modifying the method if need be.

The same steps and the same technique might well be adopted for the drafting of factory rules and regulations. Although one is tempted to stress the novelty and importance of the third step, all are equally essential.

Khorzraschiot

IF THE Russian news service of the Associated Press is to be credited, a new wage system known as the "khorzraschiot" is to be introduced by the U. S. S. R. Although the very name is bound to give nervous chills and a touch of summer ague to Representative Fish, no sane observer of the Russian experiment is going to lose any sleep over it.

Actually khorzraschiot means economic accounting. But in the new decree it is interpreted to mean that the wages of workers will in future be based upon the thoroughly capitalistic idea of rewarding extra skill and ability rather than upon the communistic theory of equal division. Each factory, plant, collective farm, mine, and railroad must take the responsibility of fulfilling contracts and adjudging wages without interference from trade unions. In a word the Soviet Union is about to adopt piecework. Although one is inclined to foresee Lenin turning over in his plate glass tomb, khorzraschiot is a move to eliminate waste and fix managerial responsibility. Granted that differences in race and temperament are involved, it should prove just as effective in Russia as in America.

Apprentice Selection

CAREFUL selection of apprentices is the key to successful apprenticeship, measured in terms of the percentage of entering candidates that eventually develop into skilled mechanics or shop supervisors. Many qualifications are sought, but the paramount ones should be aptitude and a real desire to engage in the work of the industry. These are difficult qualities to isolate, but they should be determined as early as possible.

One method that has proven successful to date is being employed in the plant of the Le Roi Company, of Milwaukee. Here a likely-looking candidate is not immediately taken into the shop; he is questioned and then asked to report again the following week for further examination. This examination is partly in written form and requires about one hour's time. But that doesn't end it; the same procedure is followed for six or eight weeks—upon each return another examination. In addition, the applicant is given some home work to do. By the end of this period, the applicant's qualifications as to his learning ability, character, and desire to continue in that type of work are fairly evident. His very patience in returning week after week to take a new examination indicates an earnest desire on his part to enter the trade.

What the applicant's home conditions are like is immaterial, nor does it matter whether the applicant is a high-school graduate or an eighth-grader. In fact, the company is doubly careful in selecting high-school graduates, because so many parents think that sons with this type of education need not work very hard, nor at hand-soiling occupations. Sons of laboring men, on the other hand, are not afraid to pitch right in.

Apprentice training is a phase of the metal-working industry that a few companies do well, others half-heartedly, and many not at all. The reason for this poor showing is that the results are often discouraging when the benefits redounding to company are compared with the expenditure of time and money to develop the few men that finally make the grade. The colleges and universities are paying more attention every year to the selection of candidates for the freshman class, using wherever possible the tools of modern psychology. It is fully as important for manufacturers to exercise equal care in appraising apprentice candidates before actual indenture.

III—Promotion of National Prosperity

A—The net profits of a modern business depend not only on its own activities but on sustained business stability throughout the country. There is a vital responsibility upon each business enterprise to do its share to provide national stability of purchasing power through—

(1) A policy for employment.
(2) A policy for dividends.
(3) A policy for 1931 expenditures.

MORE important than advice from outsiders regarding what Industry might have done to avoid 1930, is a true consensus of industry's own opinion regarding what should be done *now*. In this connection, the recent survey of the New England Council is of decided value. Fourteen recommendations, made by 739 leading New England business men, form the basis for the remainder of this week's discussion.

The first recommendation, made by 534 executives, is to "Hold lay-offs to a minimum" by eliminating overtime and then, if necessary, by reducing weekly hours. It is better to provide half-time work for the full force than to provide full-time work for half the force.

The second recommendation is "Aggressive merchandising," urged by 501 executives. Analyze past sales for most profitable lines, customers, and territories, then concentrate selling efforts on them; improve quality and utility of products; package more attractively; develop new uses for present products; develop new products to meet new or changing needs; advertise consistently; enlist dealer's co-operation in ordering in advance on seasonal requirements; enlist customer's co-operation in budgeting requirements on a monthly basis and buying more regularly; consider opportunities for exporting; and improve the sales organization.

"Improve employee morale" is the third point, recommended by 448 executives. This may be done by keeping employees informed regarding progress of the company's efforts toward maintenance of steady work, by maintaining wages and working conditions on a level that enables employees to do as well in your shop as elsewhere, by devising ways and means of making every employee have pride in his work, and striving to improve human relations within the organization.

Fourth among the recommendations comes "Encourage normal buying for normal needs by those with a steady income," recommended by 443 executives. Fifth is "Clean up, paint up, repair, and do general housecleaning," recommended by 358 executives. Sixth, "Overhaul machinery and equipment," recommended by 303 executives. Seventh: "Adopt research," by 295 executives.

Other recommendations include: Develop plant modernization, based on intensive study of floor layout for "straight-line" production—use more material-handling equipment, modern high-capacity machinery, and power installations; alteration or expansion of buildings, and changes in office layout and equipment. Invite employee suggestions for eliminating waste, thus saving money for the payroll and reducing the cost of production. Plan and budget profits, sales, and production. Establish adequate standards of quality, value, and especially performance, with suitable incentives and rewards for attainment and maintenance. Co-operate with the community in the recommendation of unemployed for jobs with regard to their relative need for work. Encourage accurate publicity on local business conditions and the extent of employment as the first step in maintaining confidence in local industries. Encourage the exchange of information between communities on opportunities for work therein, to avoid excessive and unwarranted travel expenditure by labor "hunting jobs."

Some recommendations apply to all industries; all recommendations apply to some industry. It is the task of the executives of any given company to apply to their own uses those recommendations which fit their particular needs. Only by application can these recommendations be anything other than recommendations. It is the task of business executives to make them realities.

NEWS OF THE WEEK

A laboratory session during the recent course in metallurgy of the New Jersey Chapter, A.S.S.T. Eight lectures, supplemented by laboratory work, composed the course, which stressed fundamentals for the membership

Screw Thread Survey Now in Progress

For the past month, a representative of the A.S.M.E. Sectional Committee on Standardization and Unification of Screw Threads, has been collecting samples of threaded products in New England and New York. This constitutes the beginning of a survey of the screw-thread practice of the United States undertaken by the Sectional Committee, preliminary to the revision of the present American National Standard for Screw Threads of bolts, machine screws, nuts, commercially tapped holes, published in 1924 under the procedure of the A.S.A. One hundred and fifty manufacturers and users of threaded products will be visited, each giving five samples from stock in each of twelve sizes. These samples will be forwarded to the Gage Division of the National Bureau of Standards at Washington to be measured accurately and compared with the samples of the American National Standard. Gage manufacturers have loaned the necessary thread-measuring instruments and gages.

Stevens to Hold Engineer's Camp

An economic conference for engineers will be held this summer from Aug. 30 through Labor Day, Sept. 7, at the engineering camp of Stevens Institute of Technology in northern New Jersey. Engineering alumni of Columbia University and Stevens Institute are in joint charge of the conference, which will welcome graduates of other colleges and junior members of the national engineering societies. Hours for lectures, conferences, and round-table discussions will be scheduled to permit the men in camp to make use of facilities for sport. The serious part of each day's program will have two main elements: In the morning the lectures and discussions will deal with "The Dollar Factor in Engineering," or "Technique in Calculations Involving Money"; and in the evening the open forum and round-table discussions in the evening, elements in depression, seasonal and cyclical fluctuations.

Foundry Equipment Orders Show Decided Upturn

Orders for foundry equipment, according to the index of orders of the Foundry Equipment Manufacturers' Association, showed a decided upturn in March. The index of gross orders went from 54.71 in February to 174.4 in March, while the three months' average of gross orders went from 59.9 to 98.1. Shipments were increased from 55.36 to 72.9, and the index of unfilled orders raised from 93.5 to 314.6. These figures compare with indexes of 164.1, 173.5, 194.5, and 411.1 for the same months in 1930, and 209.4, 195.6, 197.5, and 414.4 for the same months in 1929.

A.S.M.E. Plans New England Meeting

Sessions on aeronautic problems, machine-shop practice, design, power, fuels, and textiles will be included in the fourth of a series of New England meetings of the A.S.M.E. at Hartford, Conn., June 1-3. The feature will be a round-table talk on stabilization of employment, led by Howell Cheney of South Manchester, Conn. Among papers to be presented are: "Collapsing Strength of Steel Tubes," "The Strength of Thin Cylindrical Shells Under External Pressure," "Performance of Cutting Fluids," "The Influence of Chemical Composition and Heat Treatment of Steel Forgings on Machinability with Shallow Lathe Cuts," "Recent Developments in Airplane Design," "Recent and Future Developments in Aircraft Engines," "Stresses in Dished Heads of Pressure Vesssels," "Analysis of Stresses in Circular Plates and Rings with Application to Cylinders with Rigidly Attached Flat Head and Flanges," "Small Tools and Gaging for Interchangeable Manufacture," "Conventional Gages and Their Application to Duplicate Manufacturing," "Modern Textile Machinery the Result of Mill Research and Comprehensive Engineering," "Training Foremen to Deal with Human Problems in Industry," "Training Apprentices and Foremen," "Progress Report on Comparative Tensile and Shearing Behavior in Springs," and "Stresses in Curved Bars."

The U. S. National Committee of the International Electro-Technical Commission recently gave final approval to revised I.E.C. rules for electrical machinery, Publication 34. This publication was drawn up at the I.E.C. Plenary Meeting at Oslo, Norway, in July, 1930, but is the culmination of a revision in process for ten years. It covers all sizes of transformers and rotating electrical machines (except traction motors) and supersedes the edition of 1920 which, as regards rotating machines, is limited to ratings not exceeding 5,000 volts or 750 Kva.

German Machinery Industry Continues Its Decline

By Our Berlin Correspondent

DURING the past few months, German machine business has declined still further. In December, 1930, only about half of the total number of working places available in work-shops were occupied. Since the end of 1929, there has been a decrease of approximately one-quarter the number of workmen employed, while weekly working hours have, on an average, been lowered from 46.7 hours to 41.7 hours. Home trade, since the end of 1929, has undergone a steady decline in orders received. At present they are more than 70 per cent lower than at the height of business in 1927.

Reduction early this year of iron prices has caused the machine industry a saving, the influence of which depends upon the percentage of the total production costs due to the use of iron. As the price of fuel has also gone down, and tariff-wages have been lowered in several districts, production costs have been reduced to such an extent that the industry may consider a further reduction of the prices of its products. However, due to the present lack of business, the percentage part of such overhead expenses has still increased; thus it will not always be possible to lower the prices of finished products at the same rate at which other costs have decreased.

Export trade in machines in the last quarter of 1930 averaged the same as in the third quarter, its monthly average totaling $26,428,000, that is 8 per cent less than in the preceding year. In January, machine exports were 20 per cent lower than in the preceding month, but this difference is considered unusual, hence not a true index of the trend. During the past several years the export business has become increasingly important, since conditions in the home market have become steadily worse. Exports now considerably surpass the home trade. In several branches, up to 80 per cent of the total production is sold for export.

The location of the export market has changed somewhat during the last several years. Machine exports to European countries increased from approximately 76 per cent in the last quarter of 1929 to about 81 per cent in the last quarter of 1930, whereas the trade with overseas countries was on the decline on account of their decreasing buying power. This explains the comparatively favorable development of German machine export trade, as compared to that of Great Britain and the United States. Great Britain's machine exports, largely to its dominions, have decreased since the middle of 1929. However, its exports had at that time already a lower standing than Germany's, and in the course of 1930 sank by an average of 15 per cent below their highest level, as compared to a decrease of 4.3 per cent in German machine exports, the highest level of which was at the end of 1929. Hence, the greater decrease in Germany's machine industry is explicable only in the far greater decrease in home trade.

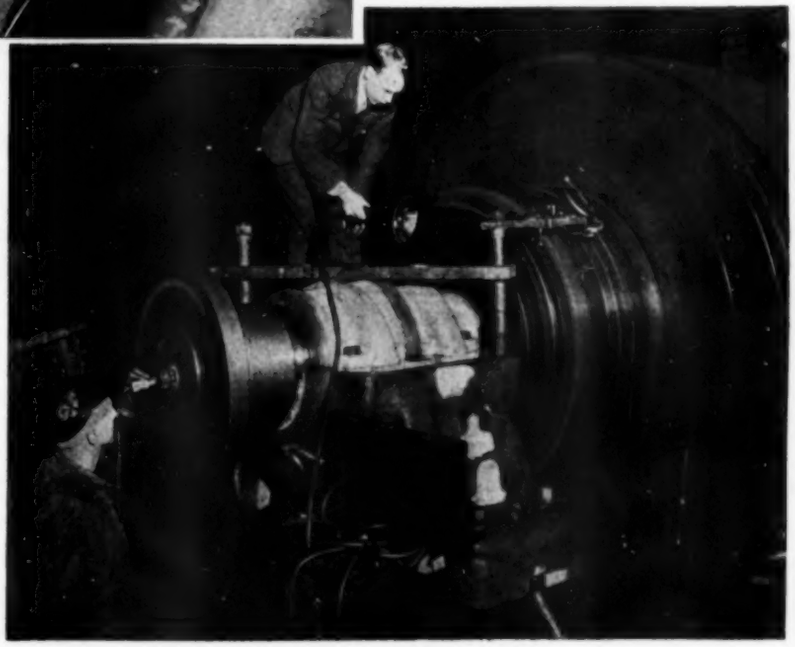
The increase of machine-tool exports is due, to considerable extent, to the improved marketing possibilities in Russia and France. These two countries alone participated in the machine-tool exports with 27 per cent in the last quarter of 1929 and 46 per cent in the same period of 1930. From the end of 1928 until the end of 1930, the German export trade in machine-tools to Russia has increased by 75 per cent, and has so far not slowed down this year. The expansion of German export trade to France is due largely to the favorable economic condition in that country, largely on account of German reparation payments and deliveries of goods.

The accompanying table permits a survey of the total exports of the German machine-industry in the period of 1924 to 1930.

GERMAN MACHINES EXPORTED FROM 1924 TO 1930

(Amount in Million Dollars)

To	1924	1925	1926	1927	1928	1929	1930
Argentina	4.71	7.04	7.17	7.48	10.33	12.16	8.50
Belgium	3.05	4.83	4.24	6.14	8.86	13.64	15.50
Brasil	5.69	10.45	9.17	6.12	7.62	8.76	4.40
British South Africa	0.57	1.52	1.10	4.80	4.00	2.55	2.12
France	3.71	5.31	5.48	9.14	15.64	33.43	47.00
Great Britain	4.57	7.93	9.48	12.43	13.60	19.24	18.61
Italy	7.45	14.26	14.73	11.04	3.40	17.02	14.85
Netherlands	8.31	11.45	12.52	14.21	18.59	22.21	20.69
Poland	9.45	9.79	5.21	12.17	17.11	14.71	8.62
Russia	2.83	9.50	15.61	29.52	31.24	26.67	43.57
Switzerland	5.57	6.98	6.33	7.90	10.52	12.57	11.88
Czechoslovakia	5.90	8.26	8.07	8.60	14.57	16.33	11.47
U. S. A.	3.07	4.52	8.24	8.12	7.83	12.12	8.19
Different countries	54.05	67.10	75.79	85.60	98.71	120.83	119.83
Total amount	118.93	168.94	183.14	223.27	272.02	332.24	335.23



The Stroboglow, portable device that makes rotating objects appear to stand still, found its first industrial application at Westinghouse in a study of the expansion of a motor rim due to centrifugal force at high speeds. Variations in rim diameter as small as a thousandth of an inch were visible. The motor rim at left is actually traveling at about a mile a minute

Trade Commission Spikes Non-Standardization Rumor

Paul Wooton
Washington Correspondent

WASHINGTON, D. C., April 28—Announcement by the Federal Trade Commission commending the Commerce Department's program of co-operating with industry in the simplification and standardization of manufactured products spikes a rumor that has created needless apprehension. A report that the Commission was about to rule adversely on simplified practice recommendations drawn up by 120 industrial groups in co-operation with the Bureau of Standards grew out of a statement by a member of the trade commission. Almost immediately the Commerce Department was bombarded by trade associations with the question whether or not the concerted action of the members of an industry on commodity simplification could be interpreted as an illegal agreement. Attorneys versed in the anti-trust laws say no, emphatically.

Political castles are tumbling in Spain but the business horizon looks good. Thus do trade analysts in Washington view the late unpleasantness to the Spanish monarchy. Spain is regarded as being relatively prosperous, judging by contemporary European standards. For one thing, Spain did not indulge in the World War and thereby accumulated something of a surplus by the profitable business of selling food supplies to the participants. Those who are familiar with European affairs have also believed for some time that a new economic trend is under way in Spain and that the country is destined to recover part of its former prestige. The coup by which Spain became a republic is regarded as more political than economic. At the same time, it is believed significant that the bloodless revolt is being led by liberals and not radicals.

The fertile ground for Republican sentiment in Spain has always been in and around Barcelona. As the leading industrial section, Barcelona has been somewhat impatient of the progress of the Madrid government toward modernization. Most of those familiar with Spanish affairs believe that Barcelona will play the leading part in forming the new republic. Spain imported $57,000,000 worth of American goods in 1930 during the depression and $80,000,000 worth during 1929. It is regarded as a good market for American products, buying twice as much from us as we buy from them.

The Tariff Commission has ordered an investigation into production costs of steel anti-friction balls in response to an application filed by the Hider Steel Ball Works, Binghamton, N. Y. The company seeks an increase under the flexible tariff. The present rate of duty is ten cents per pound and 45 per cent ad valorem, as in the 1922 tariff.

RECENT Simplified Practice Recommendations being distributed to manufacturers, distributors, and others interested in their use include R94-30 on Open Web Steel Joists and R97-30 on Bell-Bottom Screw Jacks.

A FURTHER increase in industrial activity in March was reported by the Federal Reserve Board on April 23. Factory employment and payrolls increased by the usual seasonal amount, while the volume of building contracts awarded showed considerable growth.

A GUIDE book for American business in France, the work of Trade Commissioner Thomas L. Butts of the Paris office of the Bureau of Foreign and Domestic Commerce, has been released by the Bureau. According to Mr. Butts, selling in France is entirely different from selling in any other country. There are numerous trade practices employed by the French which must be given full consideration by American exporters if they are to obtain the best results from their efforts in that market. Among the important subjects which the exporter must consider are the selection of the proper type of representative, the pros and cons of establishing a branch factory in France, taxation as applied to his business, French banking and financial practices, internal transportation facilities, and custom duties levied on his goods. Mr. Butts considers the selection of an agent a difficult problem.

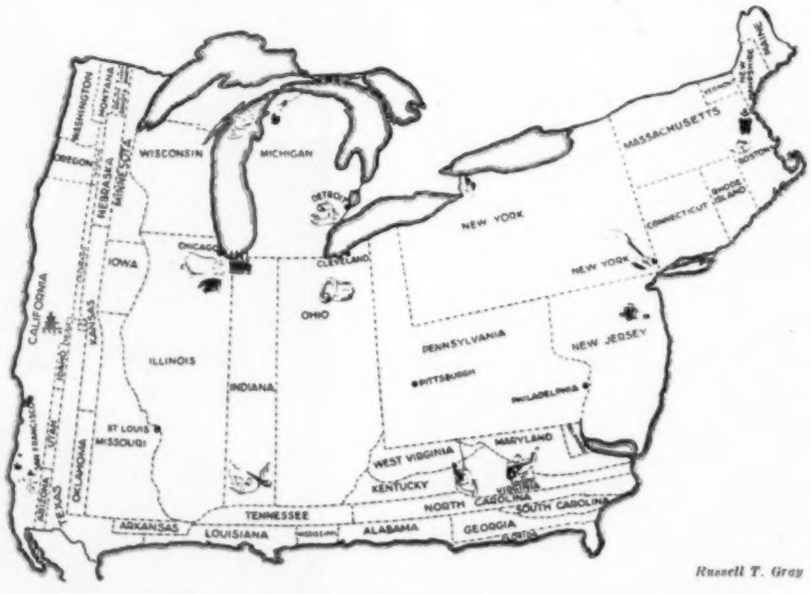
AUTOMOBILE production in March was 276,341, highest since June, 1930. This included 230,835 passenger cars, 45,096 trucks, and 410 taxicabs, an increase of 56,402 vehicles over February, according to the Department of Commerce.

"THE Support of the Aged," a monograph report just published by the National Industrial Conference Board, discusses the question of old age pensions.

"CONCERTED action is needed to bring about a revival of our export trade," declared Frank R. Eldridge, Executive Vice-President of the American Manufacturers Export Association, recently. "We have been through a world depression and the return to normal must also be world wide. Our manufacturers, who are seeking to expand their foreign markets, are, in many instances, the greatest buyers of their potential customers' raw products. When the true character of international commerce is appreciated, therefore, it is realized that only temporary dislocation due to overproduction or inadequate financial machinery for distribution can check normal international trade growth.

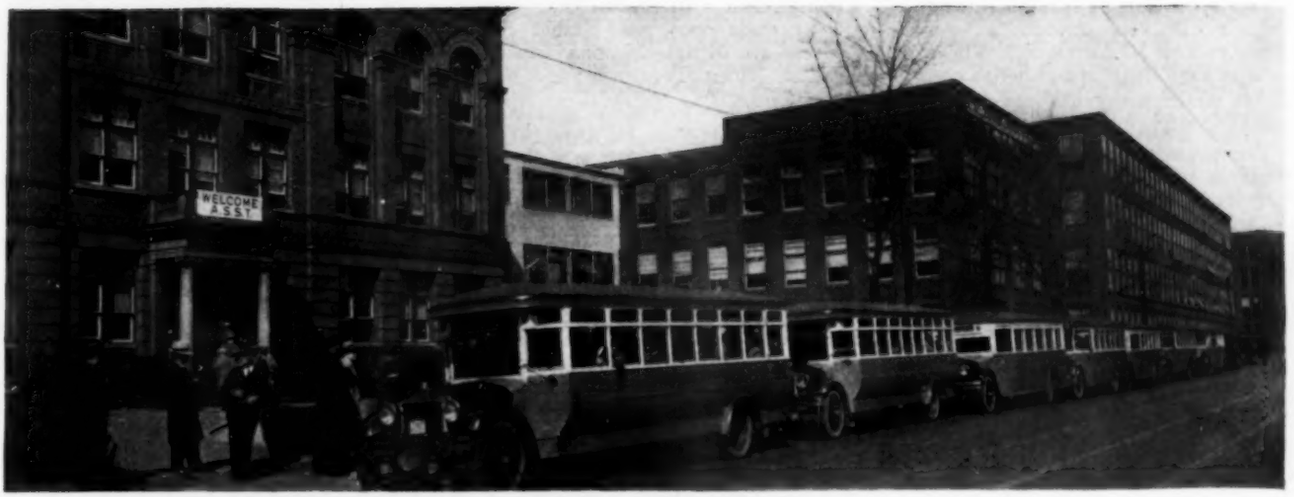
"What is needed now is a concerted movement to sell our goods abroad. This should naturally follow the plans to distribute through long time loans the world's supply of capital now congested and idle in New York and Paris. With capital available for productive enterprises in the principal markets of the world, the demands for our equipment and supplies will multiply."

James A. Farrell, President of the U. S. Steel Corporation and Chairman of the National Foreign Trade Council, will speak on international trade conditions during the May 26 Westinghouse Salute to International Trade.



Russell T. Gray

A manufacturer's-eye view of the country. Each state is given an area in direct proportion to the value of its manufactured products, according to the latest industrial census



Six hundred members of the A.S.S.T. recently inspected the Pratt & Whitney plant at Hartford, Conn. Eighteen buses brought the men to the plant, and the group at left acted as guides. Visitors were given carnations of different colors to keep various groups separate

French Exports Decline; Germany Leading Exporter

BY OUR PARIS CORRESPONDENT

French export figures from 1925 to 1928 showed a real advance, not only of consumer goods, but of production goods as well, especially mechanical aids to industry and agriculture. During the past two years the drop in total exports has been registering itself visibly. Today, its story as told by percentages is tragic. French exports dropped in 1930 as follows: United States, 54 per cent; Spain, 33 per cent; Belgium-Luxembourg, 32 per cent; Germany, 17 per cent; Italy, 16 per cent; Great Britain, 7 per cent; Switzerland, 6 per cent.

For the first time since the war, French foreign trade is showing an unfavorable balance. Also, Germany once again takes rank as Europe's chief metallurgical power, exporting more than 55 per cent of the output of its transforming industries, to a value of more than 9,000,000,000 French francs.

On the basis of the French estimates, production costs have increased 6 per cent during the past twelve months, as against a decrease of 12 per cent in Germany, and in similar proportions elsewhere. The struggle is considered so unequal that, for the moment, there is nothing to do but to mark time and trust that Germany's saturation of the French colonial market may somehow be avoided.

As for the French interior market in 1930, it actually absorbed German machinery, tools, and electric equipment to the value of 1,479,000,000 francs—one-sixth of Germany's entire export of such goods, equalling also 66 per cent of the entire French import of like merchandise. Sad reading this for American machinery exporters to France, or it would be were it not that the bulk of such imports from Germany were of a nature which, to a large extent, were non-competing with American lines.

A.S.M.E. Nominates New Officers

Nominations for officers of the American Society of Mechanical Engineers for 1932 were announced by the nominating committee as follows: President, Conrad N. Lauer, President of the Philadelphia Gas Works; Vice-Presidents, Robert M. Gates, Vice-President of the Superheater Co., Charles M. Allen, Professor of Hydraulic Engineering of Worcester Polytechnic Institute, Fred H. Dorner, Mechanical Engineer, William B. Gregory, Professor of Experimental Engineering of Tulane University; Managers, Alexander J. Dickie, Editor of the "Pacific Marine Review," Eugene W. O'Brien, Editor of the "Southern Power Journal," and Harry R. Westcott, President of Westcott & Mapes, Inc. Delegates to the American Engineering Council include: Conrad N. Lauer, Paul Doty, R. E. Flanders, C. E. Ferris, L. P. Alford, J. H. Lawrence, R. C. Marshall, Jr., A. A. Potter, W. H. Trask, Jr., and E. C. Hutchinson. Elections will be by letter ballot of the membership, closing Sept. 22, 1931.

BIGWIN, ONT., has been selected for the next Spring meeting of the A.S.M.E. The date will be June 27, 1932.

POWER-DRIVEN industrial trucks, nickel alloys in automotive manufacturing, surface hardening of steel and tantalum and tungsten-carbide milling cutters will be discussed at the spring production meeting of the Milwaukee Section, S.A.E., at the Hotel Schroeder, Milwaukee, May 7 and 8.

BUSINESS ITEMS

Final approval was voted April 20 of a merger of the Reliance Manufacturing Co., Massillon, Ohio, with the Eaton Axle & Spring Co., Cleveland.

The Reiss Efficiency Tool Co., Kokomo, Ind., will move shortly to Sturgis, Mich. The company manufactures a line of motor-driven devices for automatic setting of screws and bolts.

The Wyrick Engineering Co., Wyandotte, Mich., has moved to its new plant at 1016 Vinewood Ave., where 5,000 sq.ft. of floor space is devoted to the engineering laboratory.

The Pine Tree Die Co., Auburn, Me., has taken over the Warren S. Longmore Die Co., Stoneham, Mass. The business will be centered at Auburn.

The Isolantite Co. of America, Inc., Belleville, N. J., manufacturer of insulating materials, has changed its name to Isolantite Inc., effective April 10.

The Foote Bros. Gear & Machine Co., Chicago, Ill., has moved its general offices to 215 N. Curtis St. The move permits consolidation and better co-ordination of the general offices and manufacturing department.

The plant of the Locomobile Co. of America at Bridgeport, Conn., is to be sold June 3 by order of Judge Jennings in the Superior Court.

The Plantsville (Conn.) Foundry Corporation will be opened early in May, according to plans of this new company. Gray iron castings will be manufactured by a working force of 75 men. Frederick A. Oefinger is president; William C. Kline vice-president; and B. Frank Harpel secretary-treasurer.

Business, good will, patterns, patents, airplanes, machinery, and inventory of the General Airplanes Corporation, Roosevelt Field, Garden City, N. Y., will be sold at public auction May 16 by the Industrial Plants Corporation, Columbian Bldg., Columbus, Ohio. General Airplanes is a 4-year-old corporation valued at about $2,000,000.

Production of the Chevrolet Motor Co., Detroit, is now on a full schedule of 5½ days a week in the nine assembly and eleven manufacturing plants in the country, according to a recent announcement. Approximately 34,000 employees are on the payroll. Several plants are working both day and night shifts.

The H. D. Smith Co., Plantsville, Conn., consisting of buildings, real estate, and personal property, was sold at public auction April 15 to Grover V. Lassen, Hartford, for $35,000. The plant is equipped to manufacture hand tools, including screw drivers and wrenches. Future plans have not been decided.

The L. H. Gilmer Co., Philadelphia, Pa., has completed the purchase of the entire capital stock and all assets of the Panama Rubber Co., Chicago, Ill. All fixtures and machinery of the Panama Rubber Co. have been shipped from Chicago to Philadelphia, and all Panama rubber belts, which have been known under the trade name of "Kable-Kord," will be manufactured as "Gilmer-Kable-Kord" belts.

The Allis-Chalmers Manufacturing Co., Milwaukee, will add the manufacture of newspaper and other printing presses to its list of heavy electrical and mechanical machinery through the acquisition, by closely allied interests, of control of the Claybourne Process Corporation. General Otto H. Falk, Chairman of the Allis-Chalmers Board, has been a director of Claybourne for some time, and Herman W. Falk is chairman.

The Tungsten Widia Tool Corporation of America, 333 West 52nd St., New York, N. Y., licensees of the Krupp Company, is manufacturing a line of bits, saws, and other tools for rolling, bending, and otherwise working metal by means of tungsten-carbide alloys. This company is closely affiliated with the Union Wire Die Corporation, also of New York, the latter having done much pioneer work in introducing tungsten carbide into the United States. Officers are Morris Simons, President; Zivel B. Niden, Treasurer; and Eugene Roth, Secretary.

PERSONALS

Prof. Earle Buckingham of the Massachusetts Institute of Technology will speak on "Strength and Durability of Spur Gear Teeth" at the Fifteenth Annual Meeting of the American Gear Manufacturers Association at the Hotel Statler, Buffalo, May 7-9. His paper will be published in full in *American Machinist* for May 7. C. W. Mansur of the Plastics Department, Gear Division, General Electric Co., will speak on "Non-Metallic Gears and Their Operating Characteristics."

A. E. Geddes has resigned as vice-president and general manager of manufacturing of the American Radiator Co., New York.

George Haley has been appointed general superintendent of the Elkland, (Pa.) branch plant of the Tuna Iron Works, Inc., of Bradford, Pa., which will begin production of oil well supplies and equipment in the former plant of the Elkland Foundry & Machine Co., late this month.

Ernst C. Heyde, formerly foundry superintendent of Skalia & Co., Buenos Aires, Argentina, has returned to the United States and has been placed in charge of the pattern shop and foundry equipment for the California Foundry Co., Los Angeles.

John J. Hockey, formerly president of the Superior Casting Co., has joined the Dayton Casting Co., as traveling representative.

W. P. Hunt, President of the Moline Tool Co., was elected president of the Davenport (Iowa), Rock Island, and Moline (Ill.), branch of the National Metal Trades association, at the annual meeting last week, succeeding H. B. McKahin, Works Manager for Deere & Mansur, Moline. Other officers were elected as follows: J. L. Hecht, Davenport, vice-president; Fred W. Kirby and Harry W. Getz, directors.

George P. Torrence
Vice-President, Link-Belt Indianapolis plant, elected to the board recently

W. H. Hallstein, Treasurer and Director of purchases for the Ilg Electric Ventilating Co., Chicago, was recently elected president of the Purchasing Agents' Association of Chicago.

J. Morris Ireland, for the past five years manager of the Cleveland office, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been appointed special representative for the company. F. G. Hickling, transportation manager of the Westinghouse central district, succeeds Mr. Ireland.

S. M. Jenkins, Sales Manager in Cleveland for more than two years of the Armstrong Cork & Insulation Co., Pittsburgh, has been made assistant sales manager in charge of high-temperature insulations, with headquarters at Lancaster, Pa. He will succeed J. L. Allison, now office manager.

C. F. U. Kelly, a member of the board of directors and also a member of the executive committee of the Houdaille-Hershey Corporation, Detroit, and vice-president in charge of commercial activities, will resign June 30.

James D. Mooney, Vice-President of the General Motors Corporation in charge of the Overseas Operations group, was recently presented the Order of the White Lion of the Republic of Czecho-Slovakia.

William V. Kilborn, formerly vice-president and general manager of sales of the Graham Bolt & Nut Co., Pittsburgh, Pa., has been elected vice-president in charge of sales of the Hammond (Ind.) Bolt & Nut Corporation, with headquarters at the general offices in the Peoples Gas Bldg., Chicago.

William J. Linn, Export Manager of the Cleveland (Ohio) Pneumatic Tool Co. and the Cleveland Rock Drill Co., associated concerns has been named vice-president of the Cleveland Export Club. The election took place at the recent annual meeting.

Arthur L. Livermore, Attorney, George P. Torrence, Vice-President in charge of the Indianapolis plant, and Richard W. Yerkes, Secretary and Treasurer, have been elected members of the board of directors of the Link-Belt Co., Chicago and Indianapolis. The board has recently been increased from 9 to 12 members.

Dr. M. Luckiesh, director of the Nela Park Lighting Research Laboratory of the General Electric Co., Cleveland, Ohio, has been awarded a fellowship in the Distinguished Service Foundation of Optometry.

Lieut.-Col. A. F. Masury, Chairman of the Ordnance Advisory Committee of the S.A.E., called a Spring Meeting of that committee at Fort Eustis, Va., and Washington, D. C., on April 27 and 28.

Robert G. Matley, General Manager, Canadian Detroit Twist Drill Co., Ltd., Walkerville, Ont., was recently elected vice-president. R. T. Herdegen, President of Dominion Forge & Stamping Co. Ltd., Walkerville, was elected a member of the board.

L. A. S. Wood
All Westinghouse lighting activities have been co-ordinated in one division under his direction

William C. Meyers, formerly president and general manager of the Walred Machinery & Supply Co., Des Moines, Iowa, has been added to the executive personnel of the Davenport (Ia.) Machinery & Foundry Co., hydraulic equipment manufacturer.

Frank R. Palmer, Assistant to the President of the Carpenter Steel Co., Reading, Pa., spoke on "Tool Steel" at the April 23 meeting of the New York Chapter, A.S.S.T.

R. C. Rolfing, Vice-President of the Oliver Farm Equipment Co., Chicago, in charge of manufacturing and engineering, has resigned and will spend several months traveling.

August M. Saunders, for more than 47 years identified with the National Tube Co., Pittsburgh, lately as secretary of the patent committee and consultant, will retire May 1 and move to Los Angeles. He was superintendent of the tube and pipe mills at McKeesport for a number of years.

Oscar Schwegel has been appointed superintendent of the Dayton (Ohio) Casting Co. to succeed the late Ernest Ackerman.

F. C. Spencer, Western Electric Co., has been confirmed as chairman of the A.S.M.E. Special Research Committee on the cutting of metals by the Main Research Committee of the Society. He succeeds W. W. Nichols, who resigned just before sailing on an extended trip abroad.

Edwin C. Stout has been made assistant sales manager of the combined wire and springs departments of the Wickwire Spencer Steel Co., 41 East 47th St., New York. He will also continue as manager of the spring division.

J. R. Townsend, Bell Telephone Laboratories, and T. T. Edgerton Crucible Steel Co. of America, have been announced as chairman and secretary of the A.S.M.E. Special Research Committee on Mechanical Springs.

Alex Taylor has tendered his resignation as secretary and vice-president of the Lake Superior Corporation and secretary and director of the Algoma Steel Co. Mr. Taylor has been an executive of these companies for a period of about twenty years. His resignation was tendered in view of his taking up residence in England. He will continue to devote a certain amount of his time to the affairs of the companies in England.

J. J. Trapp has been added to the Detroit staff, at 5-207 General Motors Bldg., of The Billings & Spencer Co., Hartford, Conn.

W. W. Wilson, General Motors Bldg., Detroit, and the Metal Products & Equipment Inc., New York, have been appointed agents for nickel and nickel alloys of the Alloy Metal Wire Co., Inc., Moore, Pa.

OBITUARIES

Joseph R. Ellicott, 72, retired official of the Westinghouse Air Brake Co., died of heart disease at Ormond Beach, Fla., April 16.

Henry A. Gray, 79, who between 1886 and 1897 was secretary and treasurer of the Illinois Steel Co., Chicago, died April 20 in Lake Bluff, Ill.

Carl L. Jefferson, 49, Eastern Sales Manager for the Seagrave Manufacturing Co., Columbus, Ohio, was killed in an automobile accident at Columbia, Pa., April 17.

W. L. Bryant, President of the Bryant Chucking Grinder Co., Springfield, Vt., died April 26.

Edgar Boyd Kay, 71, former dean of the College of Engineering, University of Alabama, died at his home in Washington, D. C., April 20, of heart disease.

Samuel C. Kershaw, 59, Sales Representative of the Columbus (Ohio) Bolt Works, died April 14 after being with the company for 39 years.

Clifford E. Pierce, 50, President of the Betz-Pierce Iron & Steel Co., Cleveland, Ohio, died April 20 there after an operation.

Porter Pollock, 67, since 1913 president of the William B. Pollock Co., died of pneumonia, April 21, at Youngstown, Ohio.

George E. van Hagen, Jr., Vice-President of the Standard Forgings Co., Chicago, died recently in Miami, Fla., after an operation.

Charles A. Whiting, Vice-President and Treasurer of the Elgin (Ill.) Sweeper Co., died April 13 in St. Petersburg, Fla., of heart disease. He, with D. M. and James Todd, organized the American Tower & Tank Co. in Elgin in 1903, which was succeeded in 1922 by the Elgin Sweeper Co.

FORTHCOMING MEETINGS

AMERICAN FOUNDRYMEN'S ASSOCIATION—Annual convention and exhibition, Stevens Hotel, Chicago, May 4-8, 1931, C. E. Hoyt, 222 West Adams St., Chicago, secretary.

SOCIETY OF AUTOMOTIVE ENGINEERS—Annual Spring Production Meeting, May 7-8 at Hotel Schroeder, Milwaukee. J. A. C. Warner, 29 West 39th St., New York, N. Y., Secretary.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION—Annual Spring Meeting, Hotel Statler, Buffalo, May 7-9, 1931. T. W. Owen, 3608 Euclid Ave., Cleveland, secretary.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

National Aeronautic Meeting, Baltimore, Md., May 12-14, 1931.

Fourth New England Meeting, Hartford, Conn., June 1-4.

National Applied Mechanics Meeting, Purdue University, Lafayette, Ind., June 15-16.

AMERICAN STEEL & HEAVY HARDWARE ASSOCIATION — Twenty-second Annual Convention, May 18-20, William Penn Hotel, Pittsburgh. B. R. Sackett, 505 Arch St., Philadelphia, secretary.

NATIONAL FOREIGN TRADE COUNCIL—Annual Convention, May 27-29, at the Hotel Commodore, New York City. O. K. Davis, secretary, 1 Hanover Square, New York, N. Y.

AMERICAN MANAGEMENT ASSOCIATION—Annual Conference, Production Division, Rochester, N. Y., June 1-2. Headquarters, 20 Vesey St., N. Y. C.

NATIONAL ASSOCIATION OF PURCHASING AGENTS—Annual Convention and Informashow, Royal York Hotel, Toronto, Canada, June 8-11. G. A. Renard, 11 Park Place, New York.

NATIONAL ASSOCIATION OF FOREMEN—Eighth Annual Convention, Biltmore Hotel, Dayton, Ohio, June 12-13. Detailed information from the National Association of Foremen, Refiners Bldg., Dayton, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS—Summer meeting, June 14-19, White Sulphur Springs, Va. Green Brier Hotel. J. A. C. Warner, secretary, 29 West 39th St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Steveens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., New York, N. Y., secretary.

NATIONAL METAL CONGRESS AND EXPOSITION — Exposition on Commonwealth Pier, and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Information from W. H. Eisenman, Secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL SAFETY COUNCIL—20th Annual Safety Congress, Chicago, Oct. 12-16. Details from headquarters, Civic Opera Bldg., 20 North Wacker Drive, Chicago.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

NEW YORK

Last week was very quiet in machinery markets, which some dealers considered an indication of an early summer. In most cases, both inquiries and orders were slow, but one dealer reported a suddent influx of single inquiries for small tools upon which action was expected immediately. Sales of the week included a small grinder, a couple of shapers, and a variety of small tools. No prognostications are being made regarding the length of the lull, but dealers are rather generally agreed that upturn will depend upon general business improvement, which bids fair to be slow because of the ostrichlike attitude of business leaders.

DETROIT

Conditions are unchanged. Machinery sales have shown no improvement since the first few weeks of the year, and no immediate gain is in prospect. Automobile manufacturers still maintain a closed door policy, and all orders and requests for new machinery are subjected to a rigid scrutiny. Nothing is approved unless its purchase is essential, and even proved labor and money-saving equipment is taboo for the present. Where it is shown clearly that labor costs can be materially reduced, manufacturers reply that they are trying to increase employment rather than to diminish it. The pressure of welfare organizations and the problem of unemployment relief has made industrialists eager to keep as many men at work as possible.

CHICAGO

No change is noted in machine tool and machinery markets. It is generally felt that any change will be for the better, though the pick-up will be slow. A few Mid-West plants turning out shop equipment have found it necessary to make readjustments in wages and to reduce working hours, but in the main both wages and working forces are being maintained at the same average level that prevailed last year. Disappointment is expressed that closing is so long deferred on inquiries from industrial sources, but as nothing can be done to accelerate action, patience, perforce, is the watchword. April business to date is reported to compare unfavorably with that of March, railroad activities excepted. The C. M. S. P. & Pacific this week added 14 items to its recent list, among these being a 24-in. motor-driven boring mill; a portable pipe-cutting and threading machine; a portable open-throat punch, and a 3x18-in. motor driven emery grinder. The Santa Fe is reported to have closed on most of the items listed early this year.

INDIANAPOLIS

The machinery and machine tool business is very spotty, nor do local manufacturers and dealers expect any particular improvement before mid-summer or perhaps early fall. The little flurry in early spring has died out. Those businesses which should be most active are the deadest, including the automotive. Production in the various factories (making principally high-priced cars) is far below normal and the companies are buying just as little as possible. Demand from fabricating plants, particularly those catering mostly to the construction industry, is off considerably.

Prospects seem to be good, however. One large manufacturer of heavy machine tools said his plant had received numerous plans and specifications for tools, work entailing purchases of hundreds of thousands of dollars, but factories are holding off to see whether business will improve.

Buying on the part of the railroads, while still at a very low ebb, appears a little better than a month ago.

■

MIXED INDICATIONS of trends remain the rule in machinery and machine tool markets. Report of an upturn in one district is matched by a slowing up in another, with prospects that the next week will bring an exact reversal of positions. Business being placed is evolved principally from absolute need, a condition that is expected to exist through the summer. Prices are, however, holding and there are no declines beyond an occasional commission paring by a dealer.

NEW YORK had an unusually quiet week, only a few tools being sold, and but one or two dealers reporting increased inquiries. Detroit conditions are unchanged; no immediate gain is in prospect, since even high-production machines are tabooed in efforts to keep men at work. Chicago sees no change, railroads being the only really favorable source of business, as industrialists refuse to release tool orders. Indianapolis has excellent prospects, but few orders in hand. A number of projects will require tools, but not until "business picks up."

CINCINNATI sounds a note of cheer, several manufacturers reporting better conditions, one at least, a maker of boring mills, having business above normal. Selling agents have seen no change, and inquiries are fair. New England orders are, as a whole, small and for cheaper machines. Export and municipal prospects appear best, but financing is difficult to arrange. Canadian industry is improving steadily, with machine orders resulting and Ontario and Quebec leading. San Francisco also reports material increases in orders, inquiries, and even in export sales. The Hoover Dam is expected to bring business also.

CINCINNATI

According to some machine tool manufacturers, business has in the past week made a gesture indicating a better cycle is about to begin. An envied maker of large boring mills reports his business above normal. The majority of manufacturers consider demand about as it has been for some time, with neither loss nor gain in sales volume. Selling agents report no change in demand but expect by hard work to increase their batting average in the coming month. A large planer was sold in the past week by one manufacturer. The run of business was without feature, being principally made up of single sales to various classes of users. A fair volume of well-scattered and well-diversified inquiries were received from various classes of users, requirements in most cases being replacements of efficiency types.

NEW ENGLAND

The current week was no more fruitful of the kind of machine tool orders the trade craves than preceding weeks in April. New England orders, as a whole, are small and for the cheaper machines. Expressions of opinion ring less optimistic concerning the immediate future, and indications are that April will run slightly below March in sales.

Foreign orders hold up well, but a number of companies seem unable to negotiate closings at their terms on business still pending. Municipalities, all of whom are heavily budgeted with unemployment programs, have created a favorable market for all manner of construction machinery. Manual training equipment, too, has become a sizable factor in the sales volume.

Among the tool builders, one company reports an order for six lathes of good size. Dealers in rebuilt equipment are doing a spotty business despite excellent offerings. In all cases buyers are taking only machinery they can positively not do without. Prices continue firm.

CANADA

Steadily increasing commercial and industrial activity in all sections of the Dominion is benefiting the machinery and machine tool industry in no uncertain manner. Greatest activity is in the central provinces of Ontario and Quebec where there is a growing demand for machinery and tools for installation in the many new plants and branch factories being established as a consequence of the recent tariff changes. Steel mills and locomotive plants continue to operate on enlarged time schedules, but conditions in the iron market are compartively quiet. Sales of construction equipment have increased in keeping with the gain in building work. There is little improvement in the market for papermaking machinery, but a good volume of hydraulic machinery orders are reported by manufacturers in the east and in British Columbia. Sales of agricultural machinery are spotty, and the outlook is uncertain. On the other hand, conditions in the automotive industry are steadily improving and leaders of the industry are highly optimistic. Despite lowered prices for metals, principal mining operators are going ahead with plans for large-scale operations this summer, and there is already a good demand for mining machinery, notably in Quebec and the Maritime Provinces.

SAN FRANCISCO

Unlike many other commodities, March sales in the machine tool industry showed a material increase. Not only were several orders placed for large lathes and metalworking machines but a number of important inquiries developed and a number of heavy export shipments were made. During midwinter months the placing of orders from this field in the manufacturing centers, such as Cincinnati, was almost at a standstill. Recently several consolidated cars containing radial drills, replacements, shop equipment, heavy laundry equipment, and baking machines, have been forwarded from those centers to this territory. The sale of transmission, conveying and elevating machinery does not show any improvement, but with the advent of spring jobbers are inclined to be optimistic.

Some activity is reported in the securities of companies engaged locally in the manufacture of machinery and steel products, such as tractors, pipe, pumping machines, and the like. This activity is attributable in some degree to the construction of Hoover Dam, as local investors expect Western companies to benefit materially from orders arising out of that project.

BUSINESS • BAROMETER

Last week was quiet commercially and financially throughout the world

THEODORE H. PRICE
Editor, Commerce and Finance, New York

LAST week was quiet commercially and financially. On the Stock Exchange there were some declines, but they were largely due to the operations of aggressive bears, and there was but little compulsory liquidation. Bonds are still sustained by the cheapness of money, but investors are becoming more discriminating, and some purchases that were made during the hysteria of 1929 have been resold. Investment trusts continue to be one of the problems of the market, and their managers are gradually coming to concede that the public prefer to put their money in the organizations that publish the most complete statements of their assets and liabilities.

Railroad stocks have been soft on the continued decline in earnings reported by many important carriers. An interesting item in the railroad news of the week is a statement showing a reduction of 29,870,000 in the number of 5-cent fares collected by the New York subways and elevated lines during the eight months ended Feb. 28. In comparison with last year's total this reduction is not large, but railway officials consider it evidence of the local unemployment, and it is for that reason significant.

Freight car loadings increased slightly last week, but they continue to run far below last year's totals, and the executives in charge of America's rail traffic are becoming a little impatient while they wait for the increase in business that they have been predicting for so many months.

But the chief reason for the depression complained of is the low price level at which commodities in general are selling. The monetary value of the world's agricultural production for 1931 will be not much more than half that of 1930, and it is not surprising that the effect has been to slow down business. The problem that faces bankers and economists is that of getting commodity prices back to where they will yield a living to the farmer without oppressing the consumer, and efforts to accomplish this are being made in almost every part of the world.

On April 21, some Washington dispatches asserted that the Farm Board intended to dispose of the wheat that it is supposed to have acquired during the season now ending. These dispatches were subsequently denied, but as they included an estimate that Government holdings would amount to 275,000,000 bushels by July 1, and that all of this huge quantity would be sold, they had a very bearish effect. This was reflected in the other grain markets, as well as in the cotton market, where prices slid off about 20 points. But taken on its face, the decline in neither wheat nor cotton was serious, and the world's producers and consumers seem to have made up their minds to disregard the vagaries of the Farm Board and be governed by their own commercial sense in dealing with the facts as they present themselves from day to day. It has been asserted that the Farm Board's attitude bespeaks a desire to secure a reduction in acreage by alarming the farmers.

It is, however, doubtful whether the acreage planted will be smaller than it would have been if there had been no Farm Board or propaganda in favor of a reduced production. In other words, we appear to be getting back to the primitive methods that the Southern cotton planter followed when he had to act upon his own judgment.

The sugar market has been another disappointment to the bulls. Mr. Chadbourne's committee and machinery are all set up in Paris, but they have not yet attracted the speculative buyer, and the world has enough sugar to meet its requirements provided they are not increased by speculation.

The money market remains *in statu quo*. There is an abundance of call money at 1½ to 2 per cent, but the demand is not aggressive and stock brokers are complaining that their customers are only small borrowers.

The news from Europe is not particularly sensational. The ex-king of Spain is in London, but there is no talk of a restoration, and the present generation looks forward to a continuance of a republic. In some cables a consolidation of the Catalonian and Spanish Republics is predicted; we shall see what we shall see.

In Great Britain, despite rebuffs in the House of Lords, Ramsey MacDonald has been greatly strengthened by the support of the Liberals, and there are many who believe that the political unification that has been achieved will be of great economic value to the British Empire. Meantime, all sorts of schemes for re-attracting prosperity to England are being put forward. Some of them are plausible, and it is quite possible that we may see a revival in British trade sooner than anyone now expects.

In England as well as in East India there is continued talk of an advance in silver. There is no denying that such an advance would have a tonic effect upon business all over the world.

Certainly we seem to have reached the nadir of the present depression. In the dictionary the word nadir is defined as "the lowest point of the celestial sphere," and if its use in respect to business is justified it ought to mean an early improvement.

THE BUSINESS WEEK

April 29, 1931

The slight spring stimulus seems to have spent its force by the latter part of March and business has been backsliding since. . . . Our index has steadily declined during the past five weeks until, at 77.7% of normal, it is nearly back to the December low. . . . Security markets have closely followed suit, and commodity prices continue their relentless movement toward inconceivably low levels. . . . Seasonal building improvement seems to be weakening again, and carloadings still show little more than seasonal recovery. . . . Hope of reversal of the downward drift of steel production by May persists under expectation of larger structural and pipe-line demand, but marked increase in automotive requirements becomes doubtful. . . . It now appears likely that first quarter business improvement was only a bump on the bottom and not the definitive beginning of recovery. . . . The foreign scene has become clouded again, and Governor Norman's mission has apparently meant nothing more than further futile effort to force short-term money rates lower in hope of melting frozen long-term investment funds. . . . Our idle gold hoard piles up without increasing the means of payment by credit expansion because of paralysis of banking policy, thus prolonging price deflation, impoverishing ourselves as well as the world, and making poor old Midas appear a piker by comparison.

©The Business Week

Copyrighted
Theodore H. Price Publishing Corporation
95 Broad St., New York

THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

DESPITE the fact that declining prices appear this week in a wide variety of shop materials and supplies, there is, nevertheless, a firmer tone noted in the market for bolts, lag screws, nuts, washers and chain. Rivets, as an exception, dropped 25c. per 100 lb., to $4, base, at New York. Zinc is at lowest price levels touched in the last thirty-four years; most other nonferrous metals (except nickel) continue in poor demand. Fabricators are maintaining a livelier rate of output than that obtaining in the primary steel products. Construction continues to furnish most of the current demand, with the automotive industry using considerably large tonnages. Steel makers are absorbing more pig iron in proportion to scrap, with the result that the market for the latter is about at a standstill.

(All prices as of Apr. 24, 1931)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.69@$15.19
Tenn. Foundry (Silicon, 1.75@2.25)	14.69@ 15.19
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	18.25
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	12.00@13.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	17.76
Virginia No. 2 (Silicon, 1.75@2.25)	17 75
Basic	17.75
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.01
PITTSBURGH:	
No. 2 Foundry	18.13@18.63
Basic	18.13@18.63
Bessemer	18.63@19.13

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.45
New York	4.75
Chicago	4.50@4.75

STEEL SHEETS—Prices are in cents per lb. for sheets from warehouse stock except at Pittsburgh mill, where prices apply on large lots:

Blue Annealed*	Pittsburgh Mill	Chicago	Cleveland	New York
No. 10	1.90	3.35†	3.00	3.20‡
No. 12	1.95	3.45†	3.10	3.25‡
No. 14	2.05	3.55†	3.20	3.30‡
No. 16	2.15	3.65†	3.30	3.40‡
Black				
Nos. 18 to 20	2.05@2.15	3.60†	3.40	3.30
No. 22	2.20@2.30	3.75†	3.55	3.45
No. 24	2.25@2.35	3.80†	3.60	3.50
No. 26	2.35@2.45	3.90†	3.70	3.60
No. 28	2.50@2.60	4.05†	3.85	3.75
Galvanized				
No. 10	2.15@2.20	3.65†	3.20	3.35
Nos. 12 to 14	2.25@2.30	3.75†	3.40	3.40
No. 16	2.35@2.40	3.85†	3.50	3.50
No. 18	2.45@2.55	4.00†	3.65	3.65
No. 20	2.65@2.70	4.15†	3.80	3.80
No. 22	2.70@2.75	4.20†	3.85	3.85
No. 24	2.85@2.90	4.35†	4.00	4.00
No. 26	3.10@3.15	4.60†	4.25	4.25
No. 28	3.35@3.40	4.85†	4.50	4.50

*Light Plates. †400 to 3,999 lb. ‡1,000 to 3,999 lb., ordered and released for shipment at one time.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

List prices on which foregoing discounts apply, are as follows:

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
⅛	$0.17	1.315	1.049	.133
¼	.23	1.66	1.38	.14
⅜	.275	1.9	1.61	.145
½	.37	2.375	2.067	.154
¾	.585	2.875	2.469	.203
1	.765	3.5	3.068	.216
1¼	.92	4.0	3.548	.226
1½	1.09	4.5	4.026	.237
2	1.48	5.563	5.047	.258
2½	1.92	6.625	6.065	.28
3	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness		Outside Diameter in Inches						
		½	⅝	¾	⅞	1	1⅛	1¼
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049	18	.17	.18	.19	.20	.21	.23	.25
.065	16	.19	.20	.21	.22	.23	.25	.27
.083	14	.20	.22	.23	.24	.25	.27	.29
.095	13	.21	.23	.25	.26	.27	.29	.31
.109	12	.22	.24	.26	.27	.28	.30	.32
.120 or .125	11	.23	.25	.27	.28	.29	.31	.33
.134	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered bessemer rods	7.00	6.00	6.15
Hoop steel	3.55†	4.00	3.65†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.65†	5.00	5.00†
Cold fin., round or hexagon	3.40	3.40	3.35
Cold fin., flat or square	3.90	3.90	3.85
Structural shapes	2.90†	2.95	3.00†
Soft steel bars and bar shapes	2.90†	2.95	2.90†
Soft steel bands	3.20†	3.20	3.10†
Rivets, structural or boiler	4.00	4.00	4.00
Tank plates	2.90†	2.90	3.00†
Bar iron (2.75 at mill)	2.90	3.00	2.90†
Drill rod (from list)	65%	55%	60%

*Flat, 5/16-in. thick by ¾-in. wide. †Minimum, Chicago, 400 lb., New York, 1,000 lb., ordered and released for shipment at one time.

Electric welding wire at New York warehouse—5/32, 8.35c. per lb.; ⅛, 7.85c. per lb.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse prices in cents per lb. for small lots:

Copper, electrolytic, New York			10.75
Tin, Straits, pigs, New York			26.00
Lead, pigs, E. St. Louis	4.25	New York	5.50
Zinc, slabs, E. St. Louis	3.50	New York	5.00

	New York	Cleveland	Chicago
Antimony, slabs	10.00	10.25	10.75
Copper sheets*	20.37½	19.87½	19.87½
Copper wire*	11.50	11.62½	11.62½
Copper, drawn, round*	18.87½	18.37½	18.37½
Copper tubing*	22.87½	22.37½	22.37½
Brass sheets, high*	17.62½	17.25	17.25
Brass tubing, high*	22.50	22.12½	22.12½
Brass rods high*	15.87½	15.50	15.50
Brass wire, high*	17.75	17.75	17.75

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%, f.o.b.	24.00	24.30	23.30
Zinc sheets (casks)	9.75	11.25	10.36
Solder (½ and ½)	21.37½	21.50	18@20

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade	44.00
Commercial genuine, intermediate grade	33.75
Anti-friction metal, general service	29.00
No. 4 babbitt, f.o.b.	10.00

NICKEL AND MONEL METAL—Prices in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing	75.00*	90.00†
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

*Seamless. †Welded.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	7.50	7.50	6.75@ 7.25
Copper, heavy, and wire	7.00	7.00	6.25@ 6.75
Copper, light, and bottoms	6.00	6.00	5.50@ 6.00
Heavy lead	3.10	3.25	2.50@ 3.00
Lead battery plates	1.25	2.00	1.75@ 1.87½
Brass, heavy, yellow	4.00	4.25	4.00@ 4.25
Brass, heavy, red	6.25	6.75	5.75@ 6.25
Brass, light	3.25	3.25	3.25@ 3.75
No. 1 rod-brass turnings	4.25	4.50	4.00@ 4.50
Zinc	1.25	1.50	1.25@ 1.50

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07@$0.11	$0.13	$0.13
Cotton waste, colored, per lb.	.05½@.09	.09	.09
Wiping cloths, colored, per lb.	.10	.08	.09
Sal soda, per lb.	.01½	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.096	.099	.106
Cutting oil, about 25% lard, in 5 gal. cans, per gal.	.75	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.	.33	.36	.24
Belting—Discounts from list:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30–10%	30–10%	50%
Med. grade, heavy wgt.	30%	30 –5%	40%
Rubber transmission—List price, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	60-10-10%	50–10%	60%
Second grade	70-10%	60– 5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.029	$0.031	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1587½	.1587½	.2125
Solder (½ and ½)	per lb.	.2137½	.22	.28
Cotton waste, white	per lb.	.07@.11	.13	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia.	per 100	4.59	4.59	4.59
Lard cutting oil	per gal.	.75	.75	.75
Machine oil	per gal.	.33	.33	.33
Belting, leather, medium	off list	30–10%	30–10%	30–10%
Machine bolts, up to 1x30 in., full kegs	off list	65%	65–10%	50–10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	25.87	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.59	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.50
Coke, prompt foundry, per net ton		Connellsville,	3.25
White lead, dry	100 lb. kegs	New York,	13.25
White lead, in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65%
Larger, up to 1 x 30-in., full kegs, list less	65%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65%
Larger, list less	65%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.00
Structural, round head, broken kegs, net	4.50
Tank, ⅞-in. dia. and smaller, list less	65%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65%
Larger, up to 3-in., list less	65%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20–10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$9.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Mass., Boston—School Committee, 15 Beacon St.—will receive bids until May 6 for manual training supplies for public schools.

Mich., Detroit—Detroit Gray Iron Foundry Co., Irona and Wight Sts.—gray iron foundry equipment for proposed 1 story, 115 x 170 ft. foundry. Estimated cost $50,000.

Pa., Aspinwall—City, E. G. Lang, Dir. of Public Works, Pittsburgh—will receive bids until May 5 for a 15 ton traveling crane for Brilliant pumping station, here.

Pa., Pittsburgh — F. Tinker & Sons Co., 5649 Berlin Way, F. Tinker, Pres. (rolling mill supplies) — new equipment for proposed new factory at 5600 Butler St. Estimated cost $40,000.

Opportunities for Future Business

Conn., Ansonia—American Brass Co., Grand and Meadow Sts., Waterbury, awarded contract for additions and alterations to plant on Canal St. here. Estimated cost $100,000.

Del., New Castle — Intercontinental Pipe & Mining Co., c/o H. Kennedy Co., 122 East 42nd St., New York, N. Y., plans altering and re-equipping pipe, steel and iron manufacturing plant. Estimated cost $1,000,000. Maturity in August. Noted Feb. 19.

Ill., Chicago — Bell & Howell Co., 4033-55 North Rockwell St., manufacturers of professional and amateur motion picture making equipment, awarded contract for a 2 story, 112 x 153 ft. addition to engineering building at North Rockwell St. and Belle Plaine Ave. Estimated cost $40,000.

Ill., Chicago — Railway Express Agency, 58 East Washington St., awarded contract for remodeling stables at Sebor St. between Jefferson and Clinton Sts. into motor repair shops and office. Estimated cost $400,000.

La., Shreveport—G. E. Lamb, Constructing Quartermaster, Barksdale Field, awarded contract for the construction of a warehouse, maintenance department warehouse and garage at Barksdale Field. $72,622.

Mass., Belchertown—Dept. of Mental Diseases, plans addition to service building at State School. Estimated cost $50,000. Architect not selected.

Mass., Everett (br. Boston)—New England Fuel & Transportation Co., 250 Stuart St., Boston, awarded contract for three plant units, 1 story each, including machinery shed, conveyor belt house and coal bin at Rover St. Ext. here.

Mass., Holyoke—Dept. of Public Works, received lowest bid for the cnostruction of a 3 story, 70 x 230 and 65 x 75 ft. vocational school at Pine Beech and Franklin Sts., from Casper Ranger Construction Co., 20 Bond St. $133,700. Noted April 23.

Mass., Longmeadow — Town, F. E. Smith, Clk., awarded contract for the construction of a 2 story municipal work shop and storage building on Pondside Rd. Estimated cost $40,000. Noted April 16.

Mass., Leominster — City Property Commission, G. L. Thurston, Chn., awarded contract for a 1 story garage, electrician's room and repair shop on West St. Estimated cost $40,000. Private plans.

Mass., Melrose—Eastern Massachusetts Street Railway Co., 38 Chauncy St., Boston, plans the construction of a 1 story garage on Green St. here. Estimated cost $50,000. Private plans.

Mass., Watertown (Boston P. O.) — D. A. Papalia, 129 Waverly St., had plans prepared for the construction of a 1 story garage and repair shop at 117 Waverly Ave. Estimated cost $40,000. Private plans.

Miss., Laurel—City awarded contract for the construction of a 1 and 2 story, 30 x 100 ft. airport including hangar, worshop, etc. Estimated cost $13,000.

Mo., St. Louis—Bd. of Police Commissioners, L. O. Hocker, Pres., awarded contract for a 2 story, 112 x 134 ft. police station and garage at Kansas Ave. and Colorado St. Estimated cost $150,000. Noted Apr. 16.

Mo., St. Louis—Goodrich Silvertown, Inc., R. E. Kenner, Mgr., 23rd and Olive Sts., awarded contract for a 1 story, 80 x 112 ft. service station at Gravois Ave. and Potomac St.

N. J., Elizabeth—Fulton Specialty Co., 128 Fulton St., plans a 5 story addition to rubber stamp factory. Estimated cost $40,000. Architect not announced.

N. J., Jersey City—Montgomery Cylinder & Grinding Co., 678 Montgomery St., postponed construction of a 1 story, 68 x 100 ft. auto engine remodeling plant at Tonnelle Ave. and Allen St. Estimated cost $40,000. O. L. Wutzdorff, 147 Summit Ave., Union City, Archt. Maturity indefinite.

N. J., Newark—Fischer Auto Sales Co., 596 South 11th St., is receiving bids for a 2 story, 60 x 135 ft. auto repair shop and service station at 606-610 South 11th St. Estimated cost $40,000. R. L. Pryor, 11 Governor St., Archt.

N. J., Newark—W. Snyder, 790 Broad St., Archt., is receiving new bids for the construction of a 3 story, 50 x 100 ft. woodworking factory on New York Ave. Estimated cost $40,000. W. Snyder, 790 Broad St., Archt. Former bids rejected. Noted Aug. 21, 1930.

Every one of these items is reported by our authorized correspondents who are instructed to verify every item sent in. This free weekly service is published in the interests of the buyer and the seller, to bring them together and get machinery moving.

Everything possible is done to insure authenticity and timeliness.

Your co-operation is invited in helping us maintain this service at the highest efficiency.

BUSINESS NEWS DEPARTMENT
Tenth Ave. at 36th St., New York

N. Y., Auburn — Dept. of Correction, State Office Bldg., Albany, awarded contract for the construction of foundry and shop buildings at Auburn Prison here. $406,000. Noted Feb. 26.

N. Y., Brooklyn—Dept. of Parks, New York, plans the construction of a 1 story, 34 x 104 ft. shop and service station at Prospect Park and 9th Ave. here. Estimated cost $40,000 including equipment. Private plans. Maturity soon.

N. Y., Brooklyn—C. H. Liebfried, 112 Dobbins St., (light manufacturing), is having preliminary plans prepared for the construction of a 1 story, 70 x 100 ft. factory at Guernsey St. and Norman Ave. Estimated cost $40,000 including equipment. J. A. Napoli, 151-01 32nd Ave., Flushing, Archt.

N. Y., Brooklyn—S. Marinello, 2783 East 27th St., is having sketches made for the construction of a 1 story 100 x 100 ft. service garage at Ralph Ave. and Canarsie Lane. Estimated cost including equipment $40,000. F. C. Deheimer, 8761 24th Ave., Archt.

N. Y., Brooklyn—F. Nyse, 149 Van Sicklen Ave., is having preliminary plans prepared for the construction of a 1 story, 102 x 156 ft. service garage at Lake St. and Ave. S. Estimated cost to exceed $40,000. W. Richter, 301 Elmwood Ave., Archt.

N. Y., Brooklyn—M. Rubin, 430 5th Ave., is having preliminary plans prepared for the construction of a garage and auto laundry at Coney Island Ave. and Ave. N. Estimated cost $40,000. A. A. Blaustein, 1102 Kings Highway, Archt.

N. Y., Brooklyn—Turnschless Holding Corp., A. Schlesser, Pres., 330 Douglass St., is having preliminary plans prepared for the construction of a serivce garage at Douglass St. and West 4th Ave. Estimated cost $40,000 including equipment. W. A. Lacerenza, 16 Court St., Archt.

N. Y., Corinth—International Paper Co., 220 East 42nd St., New York, plans reconstruction of woodroom and sulphur tower in connection with paper plant recently destroyed by fire. Estimated cost to exceed $40,000.

N. Y., New York—Thirty West End Corp., N. Wallenstein, 33 West 42nd St., awarded contract for a 4 story, 99 x 100 ft. garage and storage building at 28 West End Ave. Estimated cost $100,000. Noted Apr. 16.

N. Y., Tottenville—Dept. of Water, Gas & Electricity, Municipal Bldg., New York, awarded contract for the construction of a repair company building on Joline Ave. here. $32,077. Noted Feb. 26.

O., Cincinnati—L. Wise, 917 Race St., plans the construction of a 3 story auto supply building. Estimated cost $200,000. Rendigs, Panzer and Martin, 519 Main St., Archts.

O., Cleveland—Gulf Refining Co., Frick Annex, Pittsburgh, Pa., will soon erect an oil storage plant including machine shop, boiler house, pump house, etc., at 220-250 West Jefferson St. Estimated cost $1,000,000. Noted Apr. 16.

O., Cleveland—Strong, Carlisle & Hammond, L. J. Hammond, Pres., 1394 West 3rd St. (machinery and mill supplies), will soon award contract for the construction of a 1 and 2 story, 120 x 156 ft. machine and storage building at 2801 St. Clair Ave. Estimated cost $75,000. H. M. Morse & Co., 750 Prospect Ave., Archts. and Engrs.

O., Zanesville—Zane Casting Co., plans the construction of a 1 story plant including foundry, machine shop, etc., at Park and Amelia Sts. Estimated cost $50,000. Private plans.

Pa., Conway — Pennsylvania R.R., Pennsylvania Station, Pittsburgh, awarded dredging contract for the construction of a rail river terminal including coal handling equipment and crane on Ohio River here. Estimated cost $350,000. T. J. Skillman, Broad St. Station, Philadelphia, Engr. Will also soon award contract for a 25 x 100 ft. garage, etc., at 11th and Pike Sts., Pittsburgh. C. Koch & Co., 101 Ferry St., Pittsburgh, lessee.

R. I., Newport—Bureau of Yards & Docks, Navy Dept., Washington, D. C., awarded contract for the construction of a 3 story assembly plant at Goat Island. Estimated cost $125,000.

Tex., Borger — Continental Co., is having plans prepared for the construction of a gasoline extraction plant in connection with gas pipe line from West Texas to Chicago, now under construction. Estimated cost $1,000,000.

W. Va., Chester—Harker Pottery Co., East Liverpool, O., acquired plant of E. N. Knowles China Co., here, and plans to expend $200,000 in new construction including three new tunnel kilns and factory additions. Private plans.

Ont., Fergus—Beatty Bros., plans two additional units to plant, 2 story, 50 x 150 ft. each, for the manufacture of agricultural and household implements and equipment. Estimated cost $100,000. Private plans.

Ont., Oneida—Canadian Gypsum Co., D. R. Rodgers, Ch. Engr., is having plans prepared for a plaster mill, wall board plant and warehouse. Estimated cost $100,000. Equipment will be required.

Ont., Toronto—A. L. Howden, c/o Ewing & Thompson, 371 Bay St., Engrs., plans conversion of 4 story building into garage at 21-25 Wellington St. E. Estimated cost $150,000.

Ont., Willow Grove—Canadian Gypsum Co. Ltd., plans the construction of a plaster mill board plant, warehouse and office. Estimated cost $150,000.